# THE PRINCIPLES

AND

# PRACTICE OF PHOTOGRAPHY

FAMILIARLY EXPLAINED;

BEING A

## Manual for Beginners,

AND REFERENCE BOOK FOR EXPERT PHOTOGRAPHERS.

COMPRISING

## THE COLLODION PROCESS:

PRINTING AND TONING.
THE BEST DRY-PLATE PROCESSES.
LIGHT, AND HOW TO USE IT.
HOW TO MAKE A GOOD GLASS ROOM.
COLLODION AND ITS MANAGEMENT.
NITRATE BATH AND ITS TREATMENT.
IMPROVED IRON DEVELOPERS.
CABINET PICTURES.
STEREOSCOPIC PICTURES.
BROMIDE OF SILVER PROCESS.
COPYING AND ENLARGING.
MULTIPLYING NEGATIVES.
THE SOLAR CAMERA.
LIFE-SIZE PORTRAITS.

DEFECTS, FAILURES, AND REMEDIES,
&c. &c. &c.


## BY JABEZ HUGHES,

PHOTOGRAPHER TO THE QUEEN, H.R.H. THE PRINCE OF WALES, AND THE ROYAL FAMILY.



Eighth Edition, carefully Revised.

LONDON: PUBLISHED BY SIMPKIN, MARSHALL, & CO.
4, STATIONERS' HALL COURT, E.C.
AND
JABEZ HUGHES, 379, OXFORD STREET, W.

*Price One Shilling.*

9 6
10

# THE PRINCIPLES

AND

# PRACTICE OF PHOTOGRAPHY

FAMILIARLY EXPLAINED;

BEING A

## Manual for Beginners,

AND REFERENCE BOOK FOR EXPERT PHOTOGRAPHERS.

COMPRISING

## THE COLLODION PROCESS;

PRINTING AND TONING.
THE BEST DRY-PLATE PROCESSES.
LIGHT, AND HOW TO USE IT.
HOW TO MAKE A GOOD GLASS ROOM.
COLLODION AND ITS MANAGEMENT.
NITRATE BATH AND ITS TREATMENT.
IMPROVED IRON DEVELOPERS.
CABINET PICTURES.
STEREOSCOPIC PICTURES.
BROMIDE OF SILVER PROCESS.
COPYING AND ENLARGING.
MULTIPLYING NEGATIVES.
THE SOLAR CAMERA.
LIFE-SIZE PORTRAITS.

DEFECTS, FAILURES, AND REMEDIES,

&c. &c. &c.


## BY JABEZ HUGHES,

PHOTOGRAPHER TO THE QUEEN, H.R.H. THE PRINCE OF WALES, AND THE ROYAL FAMILY.



Eighth Edition, carefully Revised.

LONDON: PUBLISHED BY SIMPKIN, MARSHALL, & CO.
4, STATIONERS' HALL COURT, E.C.

AND

JABEZ HUGHES, 379, OXFORD STREET, W.

LONDON:
SAVILL, EDWARDS AND CO., PRINTERS, CHANDOS STREET,
COVENT GARDEN.

## PREFACE TO THE EIGHTH EDITION.

In this manual the Author has endeavoured to give simple and clear directions for producing photographs. He has adopted the familiar style as admitting of the plainest and most homely language. The pupil has always been supposed to be at his elbow. The object has been to remove as many difficulties as possible from the path, and to render the commencement interesting. There has been no desire, however, to hide from the pupil the real difficulties that he may encounter in practice; he is rather prepared for them, and instructed how to meet some and avoid others.

Part I. is therefore confined to elementary manipulations and simple directions; many instructions and suggestions are more fully explained at a later part of the book, when it may be supposed that, with more extended experience, he may be better able to appreciate them.

Part II. is confined to dry-plate photography. This

is a subject quite distinct, and is fitted more for the use of amateurs than professionals. The general principle of all the dry processes is distinctly stated, and the most useful of them are fully described.

Part III. is devoted to subjects that imply a full knowledge of practical details. In this part the writer has compressed much of the matter that he has contributed to photographic literature in the form of papers to various photographic societies, and to the journals devoted to the art. His constant object, whether addressing the tyro or the experienced photographer, is to beget a love for the art and a desire for its improvement. The progress that has been made by photography is mainly due to the interchange of knowledge among those who practise the art, and, imbued with the same feeling, the larger the circle becomes, the greater will be the security that this fascinating art will arrive at still higher degrees of advancement.

RYDE, *May*, 1868.

# CONTENTS.

## PART I.

## PART II.

## PART III.

## ENGLISH WEIGHTS AND MEASURES.

| Troy or Apothecaries' Weight. | | | | Avoirdupois Weight. | | | |
|---|---|---|---|---|---|---|---|
| 20 | grains | = 1 | scruple. | | | | |
| 60 | „ | = 1 | drachm. | $27\frac{1}{3}$ | grains | = 1 | drachm. |
| 480 | „ | = 1 | ounce. | $437\frac{1}{2}$ | „ | = 1 | ounce. |
| 12 | ounces | = 1 | pound. | 16 | ounces | = 1 | pound. |

---

## FLUID MEASURE.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 60 | minims | = 1 | drachm. | | | | |
| 480 | „ | = 8 | „ | = 1 | ounce. | | |
| 160 | drachms | = 20 | ounces | = 1 | pint. | | |
| 8 | pints | = 4 | quarts | = 1 | gallon. | | |

---

## FRENCH WEIGHTS AND MEASURES.

1 gramme *weighs* nearly $15\frac{1}{2}$ English grains (15·433).

1 „ = 10 decigrammes = 100 centigrammes = 1000 milligrammes.

1 kilogramme = 1000 grammes = nearly $2\frac{1}{4}$ lbs. avoirdupois (2·247).

1 litre is equal to nearly $35\frac{1}{4}$ fluid ounces (35·2).

1 cubic centimetre is equal to nearly 17 minims (16·896).

1 *millimetre* measures in length 0·0393 inches.

1 *centimetre* „ „ 0·393 „

1 *decimetre* „ „ 3·937 „

1 *metre* „ „ 39·370 „

# HOW TO LEARN PHOTOGRAPHY.

## PART I.

### INTRODUCTION.

RESPECTED PUPIL,

I PROPOSE, in a simple and familiar manner, to introduce you to the wondrous and fascinating ART OF PHOTOGRAPHY. I take for granted that you are entirely unacquainted with it, and that you are anxious to learn. Before proceeding, however, to the practical portion, I wish to impress on your mind a few of the leading principles.

The word PHOTOGRAPHY means drawing, engraving, or writing by Light.

You are doubtless aware that white light—light from the sun, for instance—is composed of three different colours—Yellow, Red, and Blue: it also possesses three distinct properties—Illuminating, Heating, and Chemical powers. These three powers are singularly connected with the three colours. The Illuminating property exists mainly in the Yellow Rays—the Heating property in the Red—and the Chemical in the Blue or Violet rays.

With the Illuminating power you are daily familiar; the July sun gives certain proof of its Heating power; and it is your present purpose to learn that all Photography is based on its Chemical power.

For the full explanation of these facts I must refer you to Hunt's "Researches on Light;" in that excellent work is detailed in a most satisfactory manner the threefold function of a sunbeam — to illuminate, to heat, and to produce chemical change. That these three properties are distinct from each other is proved by their being separable from each other. Thus, black glass stops the illuminating and the chemical rays, but allows the heating rays to pass through; dark blue glass arrests the heating and illuminating rays, but allows the chemical ones to get through; while yellow or orange glass admits light and heat, but denies passage to the chemical rays.

Strictly speaking, then, it is not LIGHT—*the illuminating agency*—that is the cause of photographic action, but an active principle associated with it, and which is connected principally with the weakest illuminating and even *invisible* rays. This PHOTOGRAPHING POWER, then, that is associated with Light, but which is *not* Light, is termed ACTINISM.

The daily experience of every photographer proves, that though these two active principles, Light and Actinism, are constantly associated together, yet that they often exist in very different proportions to each other. There may be a brilliant light with but moderate actinic power, or a dull light and considerable photographic energy. In the autumn, when the sun's light and heat are at their maximum, the actinic power is by no means great. In winter, though the light be rather bright, the photographic power is always dull; while in early spring, before the sun has acquired his full strength, the actinic influence is relatively the most powerful in the whole year.

But in photographing from coloured objects, these facts

will be more strongly impressed on your mind. When brilliantly-lighted yellow objects "come out" dark, and dimly-lighted blue ones will appear bright, you will remember the reason,—that the former reflect abundance of light, and but little actinism ; whereas the latter throw back little light, but much actinism : and that Actinism, not Light, is the real picture-producing power.

The general term Photography embraces many processes of producing pictures, but the particular method I intend teaching you—the Collodion Process—has supplanted nearly all the others, it being not only the most perfect and comprehensive, but also the most simple.

Pictures by this process are taken on glass, and are either *Positive* or *Negative*. These terms will be explained hereafter, when the processes are described ; and it is only necessary now, before we commence actual operations, to impress on you that photography, from beginning to end, consists of a series of delicate chemical experiments. The successful execution of these depends apparently on many minute causes, which, if attended to, will produce the desired end, but which, if neglected, either from ignorance or carelessness, will as certainly cause failure and disappointment.

You must be very exact in mixing your solutions, and in using only perfectly clean vessels to put them in.

Cultivate the habit of noticing carefully all that you do ; for as there is no such thing as *chance* in Photography, you must clearly understand that when you fail, you do something different to when you succeed, and that this something *causes* the failure. As your natural desire will be to avoid failures, you must try to discover these causes, that you

may avoid them; and if you proceed in this manner you will certainly become a good and intelligent Photographer.

## THE APPARATUS AND CHEMICALS NECESSARY.

THE first thing is to obtain a Set of Apparatus. Beginners too frequently get a common cheap one, and are surrounded with unnecessary difficulties from this cause alone. There is no reason that the apparatus should be very expensive, but each article should be good of its kind. The quantity you will require will depend on the branch to which you devote yourself. A set for producing the usual sized Glass Positives will require the fewest articles. For the production of Negatives and Printing them on paper—a much higher branch of the art—more apparatus will be necessary. Should you wish to be equally well furnished for producing Portraits and Landscapes, a full equipment will be necessary. The following comprises a complete set, equally adapted for all purposes, together with a list of Chemicals, the quantities being calculated for the $8\frac{1}{2}$ by $6\frac{1}{2}$ inches, or "*whole-plate*" size. Should there be more articles enumerated than you think you will require, you must consult with some photographic friend, or explain to the person of whom you make your purchase, the description and size of pictures you wish to take, and you will be advised what articles to omit.

A Lens for Landscape and Architecture.

A well-made accordion-body Landscape Camera.

A light, strong, but portable Tripod Stand for ditto.

A travelling Glass Bath with water-tight top.

A portable Dark Tent, for working in the open air.

A Double Achromatic Portrait Lens, fitted with "Waterhouse" Central Diaphragms.

A substantial square Mahogany Camera for in-door work.

A strong, well-made Camera Stand for in-door work.

A Head-rest for attachment to Chair Backs.

A strong Iron ditto for Standing Figures.

Three Plate Boxes, 24 grooves, to suit the sizes of the Camera.

Patent Plate-Glasses to fill the above.

Set of Scales and Weights, with Glass Pans.

1 Plate-cleaning Holder.

1 or more stout Oak Printing-Frames.

1 Pneumatic Plate-holder for large Plates.

1 Developing Stand for ditto.

2 or more Porcelain Dishes.

1 Gutta-percha Tray, to be used for Hyposulphite of Soda only.

1 large and 1 small Glass Funnel.

1 Gutta-percha Funnel, medium size.

1 each 20 oz., 5 oz., 2 oz., and 60 minim, Graduated Glass Measure.

1 Four oz. tall Graduated Collodion Bottle.

1 Diamond for cutting Glass Plates.

1 Horn and 1 Boxwood Pincers.

1 Silver-bath Meter, for estimating the Strength of Silver Solutions for Bath or Printing.

A few Glass Stirring Rods.

Linen Cloths and clean Chamois Leather.

A few wide and narrow-mouthed Bottles.

A black velvet Focussing Cloth, about one yard square.

LIST OF CHEMICALS.

20 oz. Bromo-iodized Negative Collodion.
20 oz. Positive Collodion.
5 oz. Recrystallized Nitrate of Silver.
1 oz. Pyrogallic Acid.
1 oz. Citric Acid.
1 lb. Protosulphate of Iron.
1 lb. Hyposulphite of Soda.
15 gr. Chloride of Gold.
4 oz. Kaolin.
4 oz. Cyanide of Potassium.
5 oz. Glacial Acetic Acid.
5 oz. Alcohol.
1 bottle Crystal Varnish.
1 ditto Spirit do.
4 oz. Acetate of Soda.
1 oz. Bicarbonate do.
1 bottle Black Varnish.
1 ditto Plate-cleaning Solution.
1 quire highly Albuminized Paper.
1 „ white Blotting Paper.
1 book Litmus Paper.
1 packet of large round Filter Papers.
1 ditto small.

It is not necessary that you should get the chemicals in exactly the quantities given above, and for sizes below 8½ by 6½ in. smaller portions will do; yet it is not well to begin with too small a stock, as from your inexperience you will be very apt to spill and waste a quantity at first; and if you reside in a country district you may experience a difficulty in obtaining articles sufficiently pure for your use. As

a rule, it is better to buy them of those persons who supply photographic materials, from whom you will obtain them cheaper and better than from local chemists and druggists.

## HOW TO PREPARE THE DARK ROOM.

HAVING selected your Apparatus and Chemicals, the next thing is to prepare a room in which to conduct your principal operations. This is technically called a *dark room*, though, except in a chemical sense, there is no reason that it should be very dark.

Many persons imagine that any cupboard, or out of the way corner, will do to prepare plates in : this is a mistake, and if you can select a room sufficiently large in which you can move about freely, it will be much better than being cooped up and crippled in your actions. Moreover, in warm weather, the fumes from the chemicals will be injurious to your health, if the chamber be too small and ill-ventilated. Everything that can be spared should be removed from the room, and nothing allowed to remain that can be injured by chemicals being spilt upon. It should be kept very clean, for dust and dirt are great enemies to good photography. Oilcloth or bare boards are best for the floor, not carpet. A convenient range of shelves should be made round the room, and some hooks provided for hanging cloths and towels on.

You will remember I explained that the Actinic force that accompanies Light resides mainly in the blue, and scarcely at all in the yellow rays ; and photographers ingeniously take advantage of this fact by illuminating their "dark" rooms with this non-photographic light, and thus see how to prepare

their most sensitive plates. Every aperture and chink that admits white light must be carefully stopped up.

If there be more windows than one, they must be blocked out, and the remaining one covered with three folds of yellow calico; or, better still, have a hinged frame made to cover the window, and glaze this frame with dark yellow or orange glass, so that you can have yellow or white light in your room at will. If a window is not obtainable, a gas light, a lamp, or even a candle may be used, if a yellow glass be provided. An ordinary moderator lamp, with a yellow paper screen over it, makes a very fair light for the *dark* room. Persons usually make the room for preparing their plates too dark. This is a mistake; at least sufficient light should be admitted to enable you to see what you do, but it is important that this light be quite yellow. Should you commit the error of admitting too much light, you will find under the head of "Defects, Failures, and Remedies" the proper method of proceeding.

Near the window or lamp, a strong shelf or table should be placed, on which to place the bottles which you will require; and close at hand you must have a supply of water. If you can have the water laid on, with regular tap and sink, your arrangments will be perfect; failing this, you may have a cask or other vessel with a tap in it, filling it up with water as you need; or, on an emergency, use a jug, and a pail to receive your slops. Have a towel and soap conveniently placed to wash your hands with.

## HOW TO BEGIN WORK.

YOUR room being prepared, you are ready to make a commencement, and your natural desire will doubtless be to take a portrait.

But as you are a beginner, you should commence with the easiest thing, and to take a good portrait is one of the most difficult things in photography. The proper proceeding is to set up a plaster cast, engraving, porcelain statuette, or similar still-life object, and practise upon it, being prepared for many failures arising from your ignorance and clumsiness, before you attempt portraiture. You should try picture after picture, noticing carefully the faults you commit in one, so as to avoid them in the next.

In this way, by patience, observation, and practice, you will speedily gain such experience as will make your new occupation a pleasure. Above all things, do not expect to produce good pictures all at once ; and be not discouraged with failures, but try to understand why you fail.

In setting up an inanimate object to copy, the risks of failure are less than when you have a person to sit, for it will not move or alter its expression, or make remarks if you do not succeed. When brother Tom, or friend Harry is called in, the case will be different ; they will be full of fun and jokes, will most likely move at the critical moment, and say disparaging things when they find the picture a failure. All this will confuse you, and cause you to omit things you ought to have done, and do abundance of things you ought not to have done, and dishearten you in your early progress.

You had better, therefore, set up a plaster cast bust—one painted stone-colour will be best—such as those of Shakspeare,

which are so abundant, and, using this as a model, work frequently at it until you have sufficient mastery of your instrument and materials to produce, with moderate certainty, a passably good picture; then you may proceed to portraiture.

Place your object in a good light: a glass-house built for the purpose is the best; but this you may not at present be able to obtain. A well-lighted apartment will do, if you use a white screen—a sheet thrown over a clothes-horse—to reflect light upon the shaded side. A background may be formed by hanging some quiet drapery a little distance behind your object.

Now get out your portrait lens, and after wiping carefully the surfaces of the glasses with a clean silk handkerchief or chamois leather, screw it on to your portrait camera, and place them both on your heavy camera-stand opposite to your object. The ground-glass of your camera should have the sizes of the glass plates marked on it in squares, corresponding to the holders in your dark slide. Place your stand and camera so that the lens is opposite to about the centre of your object, and move the stand and camera backwards or forwards until the image of the bust is of the size, and occupies the place on your ground-glass that you wish the image to do on the plate you are going to use, remarking that the nearer the camera is to the object, the larger the object will be, and *vice versâ*. Lay the focussing-cloth on the camera; put your head under the cloth, and you will more clearly see the image on the ground-glass. Slide in or out the inner body of the camera until the image is seen quite distinctly, then fix the camera with the screw provided. While your head is still under the focussing-cloth, pass your hand round

to the lens, and move the rack backwards and forwards till you find the point at which it is most distinct.* It is then said to be "in focus," or "sharp."

You may now return to your dark room, and prepare your chemicals for "Glass Positives," these being the most easily produced photographs.

## HOW TO TAKE GLASS POSITIVES.

THE chemicals required are—

Positive collodion.
Nitrate of silver solution.
Plate-cleaning do.
Developing do.
Fixing do.
Crystal Varnish.
Black do.

The positive collodion you will purchase ready prepared. When required for use, pour three or four ounces into the tall collodion bottle; and when you have done for the day, return what remains back into the stock-bottle, that it may settle. In this manner you can always use from a clear quantity, and avoid those spots and defects which arise from a turbid or unsettled collodion.

The nitrate of silver solution is one of the highest importance. To know how much solution to mix, fill your bath with water to within an inch of the top, and measure how

* These instructions for adjusting the focus apply to the common camera. The best kind of camera is provided with an endless screw arrangement, or a rack and pinion, by which the adjustment is made more easily and perfectly.

much it holds. Suppose it to contain 25 fluid ounces;* as 35 grains of nitrate of silver to one fluid ounce of distilled water is the proper strength, 2 ounces of the nitrate will be required to form 25 fluid ounces of the necessary solution. Dissolve the silver in 4 ounces of distilled water, or boiled rain-water, then add a quarter of an ounce of positive collodion to it, shake it well for a few minutes, and add 21 ounces more of distilled water.

The solution will now be a pale milky colour, and will require filtering. Should it not run through quite clear, it must be re-filtered. Add one drop of pure nitric acid to every 3 ounces of nitrate solution, and then it will be ready for use.

## DEVELOPING SOLUTION.

| | |
|---|---|
| Protosulphate of iron ... ... | 100 grains. |
| Glacial acetic acid ... ... ... | ½ ounce. |
| Water ... ... ... ... | 10 ounces. |
| Nitric acid ... ... ... ... | 5 minims. |
| Alcohol ... ... ... ... | ½ ounce. |

Dissolve the crystals, and if the solution be not quite clear,

* It is important to notice that in all photographic formulæ, where ounces of fluid are named, *fluid* ounces are meant, and that the glass measures are graduated for the purpose. When solids are named, *Apothecaries* weight is meant. But the materials are sold to you by *Avoirdupois* weight; and as the ounce of the latter is not so heavy as that of the former, this fact must be carefully remembered, or disputes with shopkeepers, and errors in mixing your solutions, will arise. The Apothecaries ounce weighs 480 grains, and the ounce Avoirdupois but 437½ grains. It is better, therefore, in mixing nitrate of silver solutions, to estimate the quantity required in *grains*, remembering that the purchased ounce of nitrate of silver will never contain more than 437½.

filter it, then add the alcohol and acids. It will keep good until it is a deep brown colour, when it ought to be rejected.

FIXING SOLUTION.

| | | | | |
|---|---|---|---|---|
| Cyanide of potassium | ... | ... | | 60 grains. |
| Water | ... | ... | ... | 6 ounces. |

Dissolve, and it is ready for use.

Let each of these solutions be distinctly labelled, and cork the bottles when they are out of use. The fixing solution had better be legibly marked "Poison," to prevent any accidents. It should also be particularly kept out of reach of children, as it is a most deadly poison, despite its rather attractive smell.

## HOW TO CLEAN THE GLASS.

Certain fixed sizes are used by photograpers, and the glasses are sold cut ready for use.

The description of glass known as "Flatted Crown" is well suited for positives, but, before using, it requires carefully cleaning. The sharp edges should be first removed with a fine file, or by drawing the edge of one piece over the edge of another; then lay the glass on a clean flat surface, or put it in a "plate-cleaning holder," and pour a few drops of the "plate-cleaning solution" in the middle. Rub it carefully over every part with a bit of clean soft rag: turn the glass over, and do the other side the same. Then polish each side with a clean cloth, and finish with a soft chamois leather kept expressly for this purpose. Now breathe on the glass; and if the breath deposits evenly, the plate is clean. If the plate, however, shows patches and marks, it must be re-

cleaned. Let the edges be carefully wiped, and the plate is ready for use. This amount of cleaning will generally be sufficient for new glasses, but when they have been used they require more labour. They must then be well washed under the tap, to get rid of all collodion and chemicals, and be wiped on cloths kept expressly for the purpose. No soap, only plain soda and water, must be used in washing these cloths. Should the plates have been varnished, they must be soaked for some hours in a saturated solution of washing soda, till the varnish and film come freely off. The glasses must then be well washed, and treated as already described. It is a good plan, when working, to have a dish of water at hand, and to place the spoilt pictures in it at once while they are wet, and at the end of the day to wash them all, and put them away clean. By thus not allowing the films to dry on the glasses, they are much easier cleaned, and fewer failures will arise from dirty glasses.

Collodion is a good material for cleaning glasses when they are not very dirty. Pour a few drops on the glass, and well rub it with a clean cloth, and you will entirely remove all grease. A hint may thus be taken how to use up waste collodion.

## POURING ON THE COLLODION.

Remove the stopper from the bottle, and wipe from the lip any dust or dry film adhering; and, holding the plate horizontally by one corner with the thumb and finger of the left hand, pour steadily into the middle of the plate as much collodion as will half cover it. Then gradually incline the plate so that the collodion flows to each corner, not allowing it quite to touch the thumb, nor to flow a second time to any

part; then steadily pour back the excess from one corner into the bottle, and while the plate rests on the mouth of the bottle, move the plate backwards and forwards to prevent the collodion setting in crapy lines. Perform this operation coolly and steadily, and try to avoid spilling any of the collodion. A little practice will make it easy. When the collodion is set,—usually in a few seconds—the plate is ready to be immersed in the nitrate of silver bath. Lift the dipper up, and place the back of your plate on it—it will adhere by capillary attraction—and immerse plate and dipper into the bath solution with one steady dip, and continue to agitate the plate by moving it about in the bath for a few seconds. Take care it does not slip off the dipper. After agitating the plate, cover it over to keep it from light and dust. If there be the least hesitation or stop while the plate is being immersed, there will be a line marked across the plate. To know how long to keep the plate before putting it in the bath, after it is collodionized, is a point that you will gain by experience; but it depends on many circumstances, such as the nature of the collodion and the temperature; but this rule will guide you; if you put the plate in too soon, streaks and marks will be formed, commencing from where it first touched the silver solution. If you do not immerse it soon enough, the part of the plate that has become too dry will be insensitive, and will show a transparent mark. By noticing these points, you can judge whether you have made an error in the time of immersion. The plate must remain in the bath in summer time about two minutes, and in winter from five to ten.

While the plate is in the bath, you must get ready your dark slide, and see that there is no dirt in it. When

ready to put your plate in the bath, you must shut your door, and see that only yellow light illuminates the room. Lift the plate up and down in the bath several times by means of the dipper, and the agitation of the solution will remove the oily-looking lines on the surface. Allow it to remain in the bath till all apparent greasiness is removed, and the film has become creamy-looking. Then take it off the dipper, and, handling it as carefully as possible—chiefly by the corner uncollodionized—let it drain for a few seconds on clean blotting-paper, and then lay it, collodion side downwards, into your dark slide, the silver wire corners supporting it by the four corners. Close up your dark slide, and your plate is ready for use.

You may now return to your plaster cast, and removing the ground-glass frame from the camera, insert the dark slide in the place. Cover the lens with the cap, raise the shutter of the dark slide, and gently remove the lens cap, so as not to shake the camera: thus the light will be admitted to the sensitive plate. Experience can alone determine the length of the "exposure." The brilliancy of the light, colour of object, kind of lens, nature of collodion, time of day, and even the period of the year, are all modifying circumstances.

Suppose you allow ten seconds. Count the time exactly, and replace the cap on the lens. Next shut down the shutter of the slide, and take it into the dark room. Close the door, and noticing that no white light is admitted, remove the plate carefully from the dark slide. The nitrate solution that has accumulated at the bottom drain off with clean blotting-paper. Put about an ounce of developing solution into a clean measure glass, and holding the plate horizontally by the bare corner, collodion side upwards, pour

steadily but quickly along the bottom edge of the plate sufficient to easily cover it; gently incline the plate to allow the developing solution to flow uniformly backwards and forwards. Watch the "coming out" of the image. The image will quickly appear; first the parts most strongly lighted will show themselves, next the shaded portions, and when these are fully out, turn off the solution, and wash the plate well, by allowing the water from the tap to flow over it for not less than one minute, or until all the greasy lines disappear.

Lay the plate in a shallow gutta-percha dish kept for the purpose, and pour quickly over it sufficient of the fixing solution to cover it. Directly the yellow film of iodide of silver is dissolved, the plate must be lifted out and well washed. When the plate goes into the fixing solution, white light may freely be admitted. The fixing solution must be put back into its bottle, and may be used as long as it continues to dissolve the yellow film.

If the exposure be correct, and you have developed properly, you will now have a nice picture of your bust.* Your plate may be dried spontaneously or by heat. When dry, pour on the *glass* side the black varnish, just as you did the collodion, and drain off at one corner, taking care it does not flow over to the face of the picture; or, better and easier, use a black varnish made expressly for the purpose, which is to be laid on with a brush, and which dries quickly, or may be assisted with heat. The collodion surface now requires varnishing, to protect it from atmospheric action. Remove carefully with a camel-hair brush any dust or dirt

* If the picture be not perfect, refer to the chapter on "Defects, Failures, and Remedies" for further instructions.

on the picture, and pour crystal varnish over it as you did the collodion. Drain it, and, when dry, your picture is finished, and ready to be mounted.

You have now passed through the various operations, and it only requires practice and observation to make them familiar to you. Having obtained this practice, the bust may be removed, and a friend being placed in its stead, you may, by applying the same manipulations, produce a portrait. Let him sit in an easy, graceful position, and, if necessary, steady his head by the use of the head-rest. Let him look at some dark object, and allow him to wink his eyes freely during the sitting, but caution him to be quite steady in all other respects.

## HOW TO TAKE NEGATIVES.

THE pictures produced by the above method have the disadvantage that a separate sitting is required for every one; this, together with the fragility of the material, has caused the process to be less generally followed than the more complex one, where a *negative* is first obtained, from which an indefinite number of paper pictures can be produced. The practice, however, you acquire in producing glass positives will be extremely useful in producing negatives, as, up to a certain point, the manipulations are similar.

You must clearly understand the difference between a Negative and a Glass Positive. Every glass picture, to a certain extent, partakes of the nature of both; but a "glass positive" is a picture done at one operation, and complete in itself; whilst a Negative is not so much a picture as the means of producing one.

Glass positives are examined by reflected, negatives by transmitted, light; the one you hold *down* to look *at*, the other you hold *up* to look *through*; the former are black varnished to make them opaque; the latter clear varnished to give transparency. The one shows natural objects as they are—lights for lights and darks for darks; the other, just the reverse—faces, hands, and linen very dark, and black drapery quite clear. Hold a picture of each kind up to the light and look *through* them, the positive will appear thin and transparent, the negative dense and opaque; turn them down and look *at* them, the positive is clear and distinct, the negative misty and confused. The two kinds of pictures are so different that you must judge each by its own rules; for what is a fault in one, may be a merit in the other. In other words, a negative is a glass picture produced by somewhat similar means to a positive, only that in the development a much thicker and denser deposit is formed.

In fact, the negative is to the photographer what the types are to the printer; and as the latter, you know, are arranged just the contrary of the impression that is taken from them, so must the photographer's negatives—his types—be the reverse of his prints. The analogy between the two processes is so considerable, that the production of paper pictures by the aid of negatives is always termed "printing."

It will be a great assistance to you, if you can obtain from some photographer a negative that you can keep by you, to compare with your own, until you have acquired experience to know how to judge for yourself.

The same apparatus serves for the production of negatives as positives, but some of the chemicals are different; those that you require are—

Bromo-iodized negative collodion.
Nitrate of silver bath solution.
Developing do.
Fixing do.
Spirit varnish.

The *Bromo-iodized Negative Collodion* is rather different in its preparation to positive collodion, and is better adapted for giving dense pictures. It is often supplied as plain collodion and iodizing solution. It is made ready for use by mixing three parts by measure of the former to one of the latter. It is better to mix it a few hours before using, so that time be allowed for floating particles to subside.

*Nitrate of Silver Bath Solution.*—The same you used for positives will not do for negatives.

Recrystallized nitrate of silver ... 2 ounces.
Distilled or boiled rain-water ... 25 „

Dissolve the silver in four ounces of the water; dissolve two grains of iodide of potassium in one ounce of the water, and add it to the four ounces of silver solution; agitate till the yellow precipitate formed first is dissolved. Add a few drops of a saturated solution of bicarbonate of soda, agitating well between each addition, until the silver solution becomes rather milky, then add the remaining 20 ounces of distilled water. Filter, and add half a drachm of glacial acetic acid, and your nitrate bath is ready for use. Fill it up from time to time with a plain solution of nitrate of silver, 50 grains to the ounce.

DEVELOPING SOLUTION FOR NEGATIVES.

Protosulphate of iron ... ... 150 grains.
Glacial acetic acid ... ... ½ ounce.

| | | |
|---|---|---|
| Alcohol ... ... ... ... | 1 | ounce. |
| Distilled water ... ... ... | 10 | ounces. |

This solution gradually acquires a sherry colour, but its quality remains equally good. It should be filtered before using.

FIXING SOLUTION.

| | | |
|---|---|---|
| Hyposulphite of soda ... ... | 5 | ounces. |
| Water ... ... ... ... | 5 | „ |

This solution may be used until it loses its power of fixing the negative. It soon becomes discoloured, but that is of no consequence.

"Patent Plate" is the proper glass to use for negatives, as the "crown" is not flat enough. It requires the same careful cleaning as for positives. As it is more difficult to produce clean negatives than positives, you had better accustom yourself to use a glass one size larger than you require, so that the defects, which usually occur on the margin of the plate, may not spoil your picture.

Pour the collodion on the plate, sensitize, drain, and place it in the dark slide carefully, and according to the directions given for glass positives.

The same difficulty occurs with negatives, in giving any rule for the length of exposure, as in positives; the appearance of the plate during development is a useful guide, but they always require at least twice as long time as for positives. Be very careful, when your plate is in the dark slide, to keep it erect, and to handle it gently. Never knock it against anything, or it will be covered with abundance of spots from particles of dust and dirt falling on it. When in the dark room, take the plate out as carefully as before, and remove,

with clean blotting-paper, the nitrate solution that has accumulated at the bottom; and holding it by the corner, pour over it the developing solution, and in a few seconds the image will appear. After a little experience you will be able to judge, by the manner in which the image makes its appearance, whether you have given the proper exposure in the camera.

If it start out at once, directly the developer has flowed over the plate, the exposure has been too long; but if the image comes out slowly and reluctantly, and you have difficulty in making the deepest shades appear, it has not been exposed long enough.

The happy medium between these two is the correct time. When this has been given, the image makes its appearance steadily and gradually,—first the high lights, next the light shades, and finally the deep shadows. Suppose it a portrait of a gentleman—the shirt-front, face, and hands are first seen; the light folds of the drapery next show themselves; and lastly, the details in the darkest parts. If it were a positive, you would have poured the developer off before these last were seen; but, being a negative, you must carry it on until the whole of the details are clearly out, then pour the solution off the plate and wash it well. By holding your plate up to the light and looking through it, you will see the image as a negative,—the whites all dark, and dark portions nearly transparent; and if the picture appear in proper harmony, making allowance for reversed effects, the lighter portions being nearly opaque, and the darker parts very clear —*but the whole picture full of gradations and half-tones, with scarcely any parts entirely opaque, and very few clear glass*— then the development is complete; if, however, the picture

presents somewhat this appearance, but is deficient in opacity of deposit, or "density," it must be "intensified." To do this, pour over the plate as much as will comfortably cover it of the following—

NEGATIVE INTENSIFYING SOLUTION.

| | |
|---|---|
| Pyrogallic acid ... ... ... | 3 grains. |
| Citric do. ... ... ... | 1 grain. |
| Glacial acetic do. ... ... | ½ drachm. |
| Distilled water ... ... ... | 1 ounce. |

When this solution has thoroughly mixed with the water on the plate, pour it back into the measure-glass, and add a few drops of nitrate of silver solution to it (30 grains to the ounce of water), mix, and pour again over the plate; the image will speedily begin to intensify—that is, the silver will be deposited over the various parts where the light has acted. This intensifying must be continued until the parts of the negative most lighted have the requisite opacity.

This solution sometimes becomes turbid and muddy before the picture is dense enough. In such a case, pour it away, and renew with some fresh intensifying solution and silver, and proceed as before. This may be repeated many times, if needed, until the required effect is produced. Here is, perhaps, the most difficult thing you have to learn—to know how far to go, and when to stop; how to gain intensity enough to produce a vigorous negative, and yet to avoid making it too dense, and losing half-tone. As a rule, beginners over-develop their positives, and under-develop their negatives.

But it is possible to intensify too much, and make the picture so dense that you cannot print through it. You must

watch the kind of prints that different negatives produce, and when you find one that gives a brilliant yet soft image—for the real test of a negative is the kind of print it produces—study that negative well, observe the degree of opacity it has, and, keeping it as a standard, try and produce all others like it. In this way you can train and educate yourself to produce good negatives.

The development and intensifying being finished, wash the plate and lay it in the gutta-percha dish; pour the fixing solution over, and when the yellow iodide is dissolved out, give it a careful and copious washing; for if any of the hyposulphite of soda remain in the film, it will crystallize and spoil it.

Your picture now being washed, you may calmly examine it. If it appear as a moderately good but over-exposed positive, with a red and green pearly tint, and on looking through it, shows abundance of half-tones, both in the opaque and transparent parts, you may consider you have a correctly-exposed and well-developed negative, and one from which you may anticipate brilliant prints.

If, however, the negative appear as a good positive, with brilliant blacks, but rather chalky whites, and on looking through if these latter are very dense without half-tone, and the former almost like bare glass, then your picture is defective, and will only produce a hard black and white print; the fault being that it was not long enough exposed in the camera.

Should it, however, appear as a very much over-exposed positive, the whole plate having a grey film over it, obscuring the image, and on looking *through*, the details of the shadows are almost as intense as the white linen, and the whole picture is deficient in contrast, then it has been over-exposed.

The two instances I have pointed out are extreme ones: it is your object to avoid each; but of the two errors, under-exposure is the worst, for by careful printing you may get a passable proof from an over-exposed negative; but no dexterity will avail with an under-exposed one, and unfortunately, beginners' negatives, from their great desire to "work quick," have too frequently this latter fault.

## HOW TO VARNISH THE NEGATIVE.

After the plate has been well washed and dried, it is ready to varnish. If only a few prints are wanted, and you do not intend to keep the negative, you may use crystal varnish. If, however, you value your negative, and purpose producing many prints from it, the crystal varnish will not give sufficient protection, and you must use a spirit varnish which will produce a much harder surface. To use this spirit varnish, warm the negative before a fire uniformly all over as hot as the back of the hand will bear, then pour the varnish on like collodion, drain off, and dry it with heat. The proper degree of heat to use will be acquired by a little experience; if the plate be made too hot, the varnish will not flow uniformly over, but will run and dry into irregular streaks. If it be not hot enough, the surface will dry dull and dead. With the medium heat the film will dry with a hard, glossy surface. When cold, your negative is ready to be printed from.

## HOW TO PRINT ON ALBUMINIZED PAPER.

The remark has been made, that a *negative* is not so much a picture as the means of producing one; and your next proceeding is to use the negative to produce an impression on paper. This operation is called "printing," and the paper picture produced is termed a "print." There are two kinds of paper employed, plain and albuminized. The former yields a dull surface, like an engraving, and is chiefly used for pictures that have to be coloured; the latter has a glazed surface, and is the kind in general use for almost every kind of photograph, as it gives a more brilliant picture, and yields finer definition.

The apparatus necessary for printing are—

Printing-frames.
Porcelain dishes.
Gutta-percha dish.
American pegs.
Boxwood pincers.

The materials required for the operation are—

Albuminized paper.
Plain salted do.
Nitrate of silver solution.
Blotting paper.
Chloride of gold.
Acetate of soda.
Hyposulphite of soda.

*Albuminized Paper.*—This material you can purchase ready prepared. There are two principal kinds, known as *Rive* and *Saxe.* The former is a French paper, and has the highest

glaze and finest surface ; but the latter, a German one, is the most uniform in its general texture.

*Plain Paper.*—Plain paper requires preparing, or "salting," before being ready for use, or it may be purchased already salted. It is not a difficult thing to "salt" your own paper. Procure some sheets of Saxe paper, and immerse them for five minutes, removing air-bubbles, in the following solution :—

| | |
|---|---|
| Chloride of ammonium ... | ... 100 grains |
| Chloride of barium ... | ... 100 „ |
| Citrate of soda ... ... | ... 20 „ |
| Water ... ... ... | ... 20 ounces. |

Hang the sheets up to dry, and they are ready for the next operation. This may be performed in ordinary daylight.

A very simple method of using paper as "plain," that is, without glaze, is to employ the usual albuminized paper, but instead of sensitizing the glazed or albuminized side, to use the back or plain side of the paper. No salting will be required, as sufficient is already in the paper with the albumen. Many samples of albuminized paper yield good plain prints, when useless if the albumen surface is employed. The albumen helps to produce a much richer picture than is usually to be obtained on plain paper.

*Nitrate of Silver Solution.*—Whether you intend to print on plain or albuminized paper, you must make a fresh silver solution, as the one you have used for your positives and negatives is not adapted for printing ; neither will the one you are about to make serve the former purposes ; they must be kept for their separate uses. Measure how much fluid one of your porcelain dishes contains when filled half an inch deep ; say it contains forty fluid ounces. Make up the following solution :—

| | |
|---|---|
| Nitrate of silver ... | ... 3 ounces. |
| Nitrate of soda ... | ... $1\frac{1}{2}$ „ |
| White loaf sugar... | ... $\frac{1}{4}$ „ |
| Water ... ... | ... 40 „ |

When the materials are dissolved the solution is ready for use.

A double quantity should be made up, and at each time of using an additional quantity of the fresh solution should always be added, to keep the quantity up to forty ounces. This will also keep the solution at the proper strength.

*Chloride of Gold.*—This valuable substance is generally sold in bottles or tubes containing 15 grains. It is very deliquescent, and unless hermetically sealed, can only be kept in solution. Break your tube, and dissolve the contents in a bottle containing two ounces of water, and label it accordingly.

*Hyposulphite of Soda.*—Dissolve two ounces in sixteen ounces of water, and label the solution. Make a fresh quantity for every batch of prints.

## HOW TO SENSITIZE THE PAPER.

Fill your dish to the depth of not less than half an inch with the nitrate of silver solution already named. Cut your paper to convenient sizes suitable to your negatives, and lay it, if it is albuminized paper, on its glazed or albuminized side downwards on the surface of the silver solution ; if it is plain paper, lay it on the smoothest side. When it has lain for about a minute, lift up one corner with the pincers, and if there are any air-bubbles, remove them ; replace the sheet, and allow it to remain five minutes on the solution, then lift it off, taking care no solution runs over the back, and suspend it, with an American peg, to a line, in a closet or other dark

place, away from the light, where it can dry spontaneously. It is then ready for use.

Your paper ready, place your negative in the printing-frame, collodion side uppermost—be sure the glass is quite clean—and lay the paper on it, prepared surface downwards; put a few sheets of blotting-paper behind it; next put the hinged back in its place, and secure the whole tightly with the springs or other fastenings provided.

It is essential that the paper should be in very close contact with the negative to produce a "sharp" print, and you must observe that this pressure is uniform, to prevent breaking it.

Expose it to the light, and allow it to remain until printed. How long this operation will take depends on the power of the light and the density of the negative. In summer, a very short period is sufficient; and in winter, a whole day or longer may be required. To know how it is proceeding, undo the fastenings *on one side of the frame;* and by lifting up half of the hinged back, you can, without disturbing the position of the negative and paper, examine the latter, and observe its progress. First, the general outline is marked; then, the deep shadows; next, the lighter shades; and finally, the delicate half-tones. By these latter you must be guided. You must print till they are not only clearly out, but a few shades deeper than you would like them, because in the subsequent operations they will become lighter, and unless you make this allowance your print, when finished, will not be deep enough. A little experience will tell you how dark you should print. In printing portraits, you must judge entirely by the *head;* get out all the half-tones clear and distinct, so that the ultimate picture shall show the features

nice and round, not buried in black shade from being over-printed, or pale and flat from under-printing, but just such soft gradations as will make a pleasing likeness. This depth obtained, take it out of the printing-frame, and it is ready to be *toned* and *fixed*. The operations of preparing the paper, putting it into the printing-frame, examining it, and taking it out, together with the toning, should all be done either in yellow or very dull white light; for although the excited paper is not nearly so sensitive as collodion, yet a strong light, especially sunshine, will quickly spoil it for good printing.

## HOW TO TONE THE PRINTS.

If you are producing several prints, you may wait till they are all ready, keeping those first done in a drawer or other place secluded from light; but they should be toned and fixed the same day they are printed, for although these operations may be deferred, the results are seldom so good. When ready, immerse them in a dish of clean water, removing air-bubbles, and move them about, that the water may get freely between; allow them to remain five minutes; pour the water away, and refill the dish, and again wash for another five minutes, moving them about as before; change the water a third time; this last time the water should only be slightly milky; if it is more than this, the prints must be further washed.

TONING BATH.

| | | |
|---|---|---|
| Chloride of gold | ... ... | $7\frac{1}{2}$ grains. |
| Acetate of soda | ... ... | $\frac{1}{2}$ ounce. |
| Distilled water | ... ... | 40 ounces. |

This bath may be mixed in the above quantity, as it will

keep for a considerable time. It should be prepared a day or two before being used. When required for use, pour enough in a dish to well cover the prints. Take the prints from the last washing water, and immerse them one at a time ; keep them moving about, and remove air-bubbles. Until you acquire experience, you had better not have more than three or four prints in at a time. They must be closely watched, for they speedily change from their reddish-brown to a purple tint ; and if they have been printed deeply enough, the shades will pass to a purple black, while the whites will assume a delicate rosy hue. Some little experience is required to know when to take them out, but you may be guided by the general appearance as seen by looking *through* them, holding them up to the light. If they are purple when thus examined, they may be removed into a dish of clean water, to remain until they are all toned and ready to be fixed.

According to the depth to which you have printed, and the length of time they have been in the toning solution, so will the colour be. If you wish a rich chestnut brown, a very little toning will suffice ; if you like a purple brown, tone deeper ; and if a dark purple black, you must print and tone very deep. The colour of your prints will materially depend on your negatives. With a well-defined, soft, yet vigorous negative, you may produce any tone ; but from weak negatives you cannot produce good pictures. Prints kept too long in the toning solution become cold, grey, inky, weak, and flat.

If you are attentive, you will quickly gain experience enough to get, with good negatives, almost any desirable tone by modifying the depth of printing and strength of toning. The time usually occupied is from two to five minutes. In winter time the solution may be warmed, and it will tone

quicker. The preceding instructions are mainly directed to highly albuminized prints; a little modification is required for plain paper proofs; they should be printed rather darker, as they have a greater tendency to bleach during toning, and the toning solution should be more dilute.

The prints must not be toned in broad daylight, nor in yellow light, for in the latter, the shade of colour would not be seen. A weak shaded white light is the best. When the toning bath is new and strong, but few prints should be kept in at a time, and they must all be kept constantly turned over and moved about, so that they do not lie over each other, or get air-bubbles between them, and thus get unequally toned. In cold weather, it is better for the toning solution to be used warm; it will then tone much quicker. A useful plan is to fill a dish with hot water and let the vessel holding the toning solution stand in it. The colour given by the gold must not only be on the surface, but must be seen when looked at as a transparency. Unless it is toned thus far, it will probably lose all its rich colour in the hypo. Most prints thus lose somewhat of their tone, and allowance for it should therefore be made, by carrying the toning a little further; but how much further is a matter for experience to determine, according to all circumstances of the moment. Some prints tone much more readily than others; some require to be carried further, according to the subject. As some are taken out, fresh untoned ones can be put in until all are toned. They can then, unless too large a batch, be all fixed at one operation. The dish of water, into which the prints are put to wait until they are fixed, should have some common salt put into it, the quantity not important, so that it has a distinct taste. Unless this precaution be taken,

the prints will go on toning; for when they are lifted out of the bath they are saturated with toning solution. But this salt solution instantly arrests the toning action. The prints may safely be left here till all the toning is completed for the day. They are then ready for the final operation of fixing.

## HOW TO FIX THE PRINTS.

INTO your gutta-percha dish—which you must keep expressly for this purpose—pour your fixing solution of hyposulphite of soda.

FIXING SOLUTION.

| | |
|---|---|
| Hyposulphite of soda ... ... | 4 ounces |
| Water ... .. ... ... | 1 quart. |

Immerse your prints in it, and allow them to remain, separating and moving them about, so that the solution may get freely to them all. Fresh fixing solution should be used each time, as it is unsafe to use it a second time.

The prints will quickly change and lose some part of the beautiful hue they had in the gold solution, but this tint will be restored when they are finally finished.

The temperature of the fixing solution is a matter of consequence. When it is very cold, the hyposulphite materially loses its solvent action. Hyposulphite of soda in dissolving deprives the water of much of its heat. Thus a solution of hypo is found to be much colder than the water that was used to dissolve the crystals. It is better, therefore, in cold weather to use warm water. The feel of the solution to the hands will always be a good test for its temperature. It should always be such as to be agreeable to the hands. It need never be warmer, but it should not be used when it

feels cold. The crystals should be entirely dissolved before the prints are immersed in it. As much solution should be made as to allow the prints to be moved freely about in it. Not too many prints should be put in at once, and when they are in they should be separated from each other as quickly as possible, to allow the hypo to act. If the prints are allowed to adhere to each other, and air-bubbles to form between them, no end of trouble will be experienced, and the prints will probably be spoilt. All the prints should be got in as soon as possible after each other. Ten minutes will be sufficient time to allow them to remain in. They must be kept moving about and separated from each other the whole of the time. They may then be taken out and put in a large vessel of water, and the same process of separation repeated, so that the prints may as quickly as possible get rid of the adherent solution of hypo. When they are all separated and freely floating about, the water must be changed, and for the first half-hour the water must be renewed every few minutes, so as to remove the hypo solution which the prints are saturated with. This is the stage at which the most effectual washing can be done. The prints should be kept in running water, and, if your circumstances will permit, should be kept in for six hours, and then dried. If you cannot give them the advantage of a running stream, change the water in which they are soaked every half-hour for the first three hours; then soak them all night, and next morning give them two or three changes, and let them be dried. This well washing is a security that your prints will not fade, for more are spoilt from neglect of this important but irksome process than from any other cause.

## HOW TO PRINT BY DEVELOPMENT.

ANOTHER mode of printing is occasionally adopted where light only commences the operation, and the further production of the picture is by development. There are many circumstances in which this mode is very useful, especially when the solar light is too weak to produce prints in the usual manner.

The results are not so fine as by direct sun-printing, and are best adapted for large and bold subjects.

Albuminized paper is not used, but salted paper, which you may purchase ready for use, or prepare for yourself as follows :—

| | |
|---|---|
| Chloride of ammonium ... ... | 90 grains |
| Water ... ... ... ... | 10 ounces |

Immerse the paper—Towgood or Saxe is best—for five minutes, then hang up and dry; sensitize on the following bath according to the directions previously given :—

| | |
|---|---|
| Nitrate of silver ... ... ... | 45 grains |
| Glacial acetic acid ... ... | 3 minims |
| Distilled water ... ... ... | 1 ounce |

When dry, expose under a negative till a very faint picture is seen, then take it into the regular dark room and place it in a very clean dish; pour over it a saturated solution of gallic acid. It will take from five to twenty minutes to develop. When the print is fully out—you must get rather a strong impression, as it loses a little in fixing—wash it well in plain water, changing two or three times, then immerse in the hyposulphite fixing bath, already named, for other prints. Allow it to remain ten minutes.

then wash well, obeying all the instructions already given on the same subject. Prints produced by this formula are a very good colour, and do not need toning.

## GENERAL REMARKS ABOUT PRINTING.

It is scarcely possible for you to over-estimate the value of good printing. All your preceding operations will be but preparatory steps to this one. A good print, one that it is a pleasure to look upon, is an adequate reward for much time and labour. Good printing depends on many things; and the first step towards obtaining a fine print is to get a good negative; this secured, it is surprising how many of your troubles will be removed. The next most important step is to get good albuminized paper. To produce this article uniformly good seems hardly possible. No two samples of paper from the manufacturer seem ever to be the same, and the source of trouble is more often found there than in the albuminizing. The paper used to spread the layer of albumen upon is chiefly foreign made. Paper made in this country does not suit the photographer so well as that made abroad.

*Distinction between Saxe and Rive Papers.*—France and Germany furnish nearly all the paper that is used, and each has its own peculiarities. Neither is a perfect paper. The principal French paper is known as *Rive*, from the place where it is made, and its peculiarities are more or less the same as those of all French papers. It may, therefore, be taken as the type. The German papers are usually described as *Saxe;* though they are made in all parts of Germany, yet the mode of manufacture is very generally the same. *Saxe paper*, therefore, represents that made by a particular

method common to a large district, and is indicative of a certain character considerably different from the French or *Rive* paper.

*Rive* papers are much harder on their surface than *Saxe*, and the albumen sinks in less, giving, therefore, a more highly glazed face. This is very well adapted for cartes-de-visite and stereoscopics, but it is not so well suited for larger work, as the paper is apt to tear in the washing. Blisters are also more abundant; but the numerous holes and metal spots always found in this paper are its greatest objections. The film of albumen seems not to take so kindly to this as to the *Saxe* paper, hence there are more streaks and markings; yet, with all these drawbacks, this paper is a favourite, in consequence of its brilliancy. *Saxe* paper is much more uniform in its texture; it has scarcely any of the defects of the *Rive*, yet the albumen forms a duller surface, and the pictures seem more sunken into the paper. In practice it is much more economical to use, as there is less waste with streaks, markings, or metal spots. Some samples may be obtained with a much higher glaze than others. The tones yielded by these two papers are rather different. The *Rive* yields warm browns and purples, the *Saxe* gives purple blacks.

## HOW TO MOUNT THE PRINTS.

When dry, the print will be very curly; but if ironed on the back with a clean, warm, flat iron, it will lie smooth, and then it may be cut and trimmed as taste dictates.

Hot thin glue may be used to mount them on cardboard; but starch, such as used for household purposes, and about the same consistency, is equally adapted. It should be used

cold. To complete them, they should be sent to the hot-pressers, who, for a very small charge, will glaze or roll them, which will communicate a highly-finished appearance.

## DEFECTS, FAILURES, AND REMEDIES.

"Humanum est errare."

My worthy Pupil,—In the preceding instructions I have been as clear and as simple as I could, and have avoided explanations that, in your early progress, might embarrass you. That you may be successful is my ardent wish; yet, as there is no royal road to photography, it is more than probable that you will be beset with many of the troubles common to the practice of the art.

It may be a melancholy satisfaction to know that the cleverest practitioners are subject to them in common with the less skilful; the difference, however, being, that the former, by perseverance, overcome them, while the latter give up the contest, and are beaten.

If there were no difficulties to be surmounted there would be no credit in excellence, and one of the stimulants to advancement would be denied to the student of photography. The difficulties, however, that constantly arise, afford abundance of opportunity for the exercise of ingenuity, intelligence, and patience. It is sufficient to say, if you meet with few of them, deem yourself fortunate; and if you encounter many, be not discouraged, but strive to overcome them.

Generally speaking, to point out the origin of a defect is also to suggest a remedy. It is impossible to anticipate where your difficulties will be, for the experience of no two

exactly agrees; but you must endeavour to *understand* the process, and to grasp the *spirit* of the directions. Above all things, resolve to be neat and clean in your manipulations, cool in your manner, and exercise an observing eye; by these means you will certainly escape from nine out of ten of the beginner's troubles.

Whether a person shall succeed or fail in photography depends very much on the spirit with which he commences. If he think the whole process a *mechanical* one—mainly a question of apparatus, baths, and developers—he has no pleasant future. When he gets into difficulty—which he soon does—he declares his chemicals are wrong, his bath is out of order, his camera is bewitched, and he is ready to blame anything and everything, rather than his own defective manipulation; instead of calmly endeavouring to find out in what his trouble consisted. Possibly he may have mixed his plain collodion and iodizing solution in reversed proportions, or strengthened his nitrate bath out of the unlabelled hypo bottle, or been trying to develop with his cyanide. Such a man soon wears himself out; declares "it's no use trying, it's all chance;" and attributes the success of skilful men to the use of "secret dodges."

As a contrast, observe another man, who begins quietly and steadily, and, getting into trouble, thinks it probable that *he* is wrong, and not the chemicals; and, instead of throwing them down the sink, perseveringly proceeds, finally discovering that the same chemicals that formerly gave him bad pictures now furnish good ones, the difference being only *in the mode of using them.* A man of this stamp, taking pride in his new acquisition, and not blind to his own deficiencies, reads the Journals, joins a Photographic Society if he can,

compares notes with others who practise the art, keenly enjoys a visit to a Photographic Exhibition, and speedily becomes an intelligent and clever manipulator.

## DEFECTS COMMON TO GLASS POSITIVES AND NEGATIVES.

*"Fogging," that is, a darkening of the film all over, directly the developing solution is applied.*—This defect has several sources. It may exist in a small degree, only slightly obscuring the shadows of the picture, or it may be to so great an extent as to prevent its appearance. Fogging often troubles the young beginner, and as it arises from many causes, it is often difficult to assign it to the right one. Sometimes deleterious vapours are the reason; as—the dark room being built over a stable, and filled with reeking vapour; the room being newly-painted with a slow-drying paint; a leakage of gas; a bottle of ammonia with a badly fitting cork or stopper. A remedy for any of the above is simply to remove the cause.

In extremely warm weather the developing solution is much more energetic, and fogging may thus arise from this increased energy: remedy, dilute it one-half or double the quantity of acid. The following are, however, the most usual causes of fogging:—

Alkalinity of nitrate bath: remedy, addition of acetic acid till litmus paper is *slightly* reddened.

Extreme acidity of nitrate bath: remedy, addition of oxide of silver or ammonia until litmus paper is only slightly reddened.

Omission of acetic acid in the developer: remedy obvious.

Over-exposure in the camera: remedy obvious.

Diffused light in the dark room. If yellow calico be used,

it has perhaps become bleached, and must be replenished; or additional folds must be used. Sometimes chinks of unsuspected white light are the cause; if so, they must be stopped up.

Diffused light in the camera or the dark slide, admitted through a joint giving way, or an old screw-hole, or the parts of the camera not fitting: remedy obvious.

Nitrate bath made with impure silver, or bad water: remedy, add a few drops of saturated solution of bicarbonate of soda until the bath solution remains turbid after shaking; then expose it to the sun for a few hours, and filter; acidify it if necessary.

Newly-mixed collodion will sometimes cause fogging; it then requires to be kept for a few days, when it may work clean; or it may be mixed with some older collodion, and may then be all right. Sometimes a little more acid added to the bath or the developer will be a remedy. If none of these aids are sufficient, then the collodion must be rejected.

When you make any change—such as having a new camera, a fresh nitrate of silver bath solution, a new quantity of developer, or another sample of collodion—you may be able at once to suspect, and perhaps detect, the cause; for if some change occurs in the nature of the pictures which did not exist before, it is very probable that this fresh circumstance is directly connected with the changed character of the pictures. Therefore, whatever it is that has been newly introduced should be carefully examined, and very probably the cause of the fogging may be discovered. When, however, you have no such clue, you must adopt a systematic method for its discovery. The following is the plan:—

First, examine your dark room, by covering your yellow

window with some material that entirely excludes *all light.* Crevices and cracks admitting white light may then be seen that before were unnoticed, and some of them may have shone on the glass during its preparation, and caused fog. If these are found, they must be stopped up, and your annoyance may be over.

If these be not the cause, next suspect the window, for though it may admit only yellow light, it may not be yellow enough. Yellow materials become bleached, and require renewing, especially yellow calico. To test your window—and it is very important that you be quite certain on this point—proceed as follows: collodionize a plate as usual, and immerse it in the bath; then cover up your yellow window entirely, or leave only the smallest possible chink, so that you can just see what to do. Take your plate out of the bath and put it in the dark slide. Now remove the covering from the yellow window, and draw up the shutter of the dark slide *half way,* to expose *one half of the plate;* keep the plate to the light of the window for, say, five minutes, then replace the shutter, close up the window as before, so as to exclude the yellow light, and proceed to develop your plate. Keep the developing solution on about the usual time that is required to produce a picture, for you will not be able to see what is going on; then wash and fix it. Now restore the light and examine the plate, and it must present one of the three following appearances:—Case A, the half exposed to the window is drab, and the half not exposed is quite clear and transparent; Case B, it has a drab deposit—in other words, fog—all over it; Case C, the plate is perfectly clear and transparent all over.

We shall examine each of these cases in succession. Case A

shows that the yellow window is at fault, for half the plate exposed to it is fogged, but the other half is clear; therefore sufficient actinic light passes through the window to injure the plate. The yellow covering, if bleached, must be removed, or more coverings must be supplied, and a plate must be tried after each addition, until you have your window so yellow that a plate may be exposed five minutes without being fogged. Yellow glass sometimes allows light enough to pass through to fog the plate; such glass should be removed and a better sample put in its place. I have seen a piece of yellow-brownish glass, though very dark in colour, that admitted actinic light almost as freely as white glass. This is rare, but in photography you try all things, and only hold fast to that which is good. If the window be discovered to be the cause of your trouble, it must be covered with fresh calico, tammy, silk, paper, glass, or other yellow material; or it may be painted yellow; but in some manner the light must pass through a yellow screen in such a way that, while you are permitted to see your manipulations, your plate must remain without fog. You must have no rest till this is accomplished. This done, your fogging trouble is over, and you may proceed to work in comfort; for Case A clearly showed the window was the cause of the fog.

It should be borne in mind, however, that the amount of protection that a yellow window gives to sensitive plates depends upon the quantity of light that falls upon the window. Plates may be fogged on a day of sunshine, and yet be perfect on a dull day. A yellow window with a western aspect may suit a morning light, and yet cause fog in the afternoon. When the window of the developing room is thus exposed to a variable light, it should be provided with an additional

moveable yellow curtain, to be used when a stronger light than usual falls on the window.

If the cause of fogging has thus been satisfactorily traced and cured, it will form an excellent lesson. But as there are other causes of fogging than an imperfect yellow window, let us examine Case B.

Case B, the plate darkens all over under the action of the developer, and you can distinguish no difference between the two halves: this shows that your window is quite right, and you must seek further for the cause. It must now lie between the bath, the collodion, and the developer. First, try the bath; test it with a strip of reddened litmus paper, and if it changes to blue the bath is alkaline, and an alkaline bath is a certain cause of fogging. Add acetic acid, drop by drop, testing between each addition, until blue litmus paper is *very* slightly reddened. Again try a plate; the fogging will probably not be quite gone, but much reduced: add a little more acid until it entirely disappears.

Suppose, however, that the reddened litmus paper did not change colour, then test with blue litmus, and if it turn *very* red, carefully neutralize with oxide of silver, or ammonia, until only a slight acidity remains; then resume your trial to see if you have expelled your enemy, for excess of acid, especially nitric, will cause fog. Should the test-papers show that the bath is neither very acid nor alkaline, the probability is that the error is in the developer or the collodion.

Make up, carefully, a fresh developing solution, being particular not to omit the full proportion of acetic acid. You may even increase the quantity of acid, for some samples are weak, and you may happen to have one: the developing

solution, unless it have its proper addition of acid, will always cause fog. If the new developing solution rid you of your difficulty, well and good; if not, you must suspect your collodion. Some collodions cause fog, therefore get some fresh, and let it have a little colour—a pale golden, for instance—for colourless collodions are more prone to fog than coloured ones. If you are not now relieved, you may assume that the nitrate bath is the defaulter, for it must be one of the three. Make up a new bath, and if you use good silver and clean water, you are almost certain to be out of your trouble.

In this way, by carefully and exhaustively examining one thing at a time, you will be certain to trace out the delinquent material. If you have decided that the nitrate bath, for instance, is the cause, then you have, if it be a new one, to find out whether the sample of nitrate of silver is pure, or whether the water is not the cause. The latter is frequently an unsuspected source of trouble. Again, if it be found that the developer is at fault, supposing it to be correctly mixed, each of its components may be suspected and examined in turn—the iron, the water, the acetic acid, and the alcohol. Some samples of methylated alcohol often cause great annoyance by impurity.

To return to our examination: supposing that we have not yet discovered the cause of our fog; the conditions of Cases A or B not applying, let us examine the rest.

Case C, the plate develops perfectly clean and transparent all over: this shows not only that the yellow window is all right, but that the chemicals are right also; in fact, that the origin of the fog must be external to the dark room; and as nothing else but diffused light can now be the cause,

we must seek to discover it. First, examine the dark slide well; in some unsuspected manner it may admit light to the plate.

If your dark slide be found to be perfect, next examine your camera carefully. You may test it in this manner: prepare a sensitive plate as usual, and place it in the camera as if you were going to take a picture; put the cap on the lens, draw up *half way only* the shutter of the dark slide, but do not uncover the lens. Let the plate remain thus for a full minute, then develop and fix the plate. The plate will either be one-half fogged, or it will be quite clear all over. If half be fogged, it shows that the camera admits light in some other manner than through the lens, and thus the fog is caused. To know where the light is admitted, remove the ground-glass; and, excluding all light with the focussing cloth, put your head into the camera (the lens being still covered), and you will see the light streaming in. You may examine the interior of your camera in another manner. Place the dark slide in its place, and draw up the shutter; remove the lens, and with the aid of the focussing cloth again examine the interior through the flange aperture. If any stray light be admitted, you will see it reflected from the face of the plate. It is necessary, when thus examining the interior of a camera, to wait for a few minutes, to allow the eye to get accustomed to the darkness, or you may deceive yourself, and think there is no light, from your momentary inability to perceive it. The cracks, crevices, or holes being stopped up, your trouble is passed.

Should your plate, however, develop clear all over, it will show that the interior of the camera is perfect. Another cause of fog may arise from the lens itself. If a strong light

fall on it, particularly sunshine, fog will certainly be produced. A screen or shade should be provided, so that no light fall on the lens, except from the objects that are being delineated. Occasionally there is reflection from the sides of the lens tube, or the edges of the back lens. Dead-black varnish will be the remedy in these cases.

If you have not now traced out the difficulty, having run through your chemicals and apparatus, it most probably is caused by an error of manipulation, such as over-exposure, or a deviation from the proper mode of developing. It is scarcely probable, however, that you could pursue this inquiry without already having a clue to the real cause; and I have gone through the series of exhaustive experiments to show you that, by this method of inquiry, you may succeed in tracing not only fog, but almost any other trouble to its true source.

*Transparent spots.*—Causes: collodion not settled; bath requires filtering; dust in the camera; knocking dark slide when plate is in; bath not saturated with iodide of silver, or supersaturated with iodide of silver.

*Opaque spots.*—Causes: developer not filtered; dust falling on the plate while being coated; dirt, and dried fragments of collodion from lip of collodion bottle; dust and dirt from dark slide.

*Streaky lines in the direction of the dip.*—These are often caused, in a new bath, by a deficiency of acid; in an old one, by the accumulation of ether and alcohol. Remedy: in the first, add acid cautiously till the streaks disappear; in the second, mix with it an equal bulk of fresh 35-grain solution of nitrate of silver, or, better still, make up a new bath.

There is, however, another cause for these streaks, the

remedy for which is very simple; it is to gently agitate the plate directly it is placed in the bath, and to keep it moving for twenty or thirty seconds afterwards.

*Sharp horizontal lines across the plate.*—These are caused by hesitation in dipping the plate into the bath.

*Collodion film mottled and thick.*—The collodion requires diluting with a little plain ether.

*The collodion film, on drying, peels off the glass.*—This is often due to inferior collodion; but the most usual cause is dirty glasses. It will arise also from pushing the development too much in cases of under-exposure. Also from intensifying weak images by bichloride of mercury or other intensifiers.

*The collodion film is full of honeycomb-like markings; the film has transparent, crapy, diagonal lines, especially where the deposit is greatest.*—These defects all arise from inferior collodion; procure some of better quality.

*Opaque white marks and streaks at the end of the plate where the collodion was poured off.*—Keep the plate a longer time before you immerse it in the bath; if this does not prevent the markings, add a little plain *un-iodized* collodion.

*Transparent insensitive mark at the opposite end to where the collodion was poured off.*—The plate was kept too long out of the bath, and the upper part has become dry; the plate must be immersed sooner into the bath.

*Markings like curtains and fringes.*—When these do not occur from bad manipulation—and be careful not too hastily to decide—these faults may arise from the collodion or the bath, and the best remedy is to endeavour to obtain samples that will work without thus plaguing you. When a strong iron developer is used, it is important that you have the proper quantity of alcohol in it, as this causes the solution to

flow easily and smoothly all over the plate, and allows the developing solution readily to combine with the silver solution which is on the film. When the developer flows in irregular greasy lines, there are sure to be abundance of stains from this cause alone.

## DEFECTS IN GLASS POSITIVES.

*The light parts are pale and misty, and what should be the dark parts are drab-coloured.*—Over-exposure produces this effect; reduce the time in the camera, or place a smaller diaphragm in the lens, to cause it to work slower. If this treatment does not remove the mistiness, it may be produced by some of the causes of "fog," the remedies for which have been previously stated.

*The blacks are very deep and brilliant, but deficient of detail, and the lights rather dark.*—The exposure in camera is not sufficient, or the developing solution was poured off too soon.

*The picture, after washing off the cyanide solution, has blue stains.*—The developing solution has not been sufficiently washed away before the fixing solution was used.

*The shadows of the picture are clear, but the light parts are chalky, and deficient in half-tone.*—The developing solution has been kept on too long.

*The picture is brilliant when wet, but on drying becomes dull, the shadows being misty blue instead of bright black.*—Bad collodion is the cause of this defect.

## DEFECTS IN NEGATIVES.

*The picture very intense where the light has acted most, and nearly transparent in the shadows.*—The plate is under-exposed and over-developed.

*The shadows have nearly as dense a deposit as the high lights.*—The plate is over-exposed.

*The image will not intensify under the action of the pyro-gallic acid and silver solution.*—There are many causes for this defect, and you must discriminate which is the most probable in your own case, and act accordingly. Bad collodion —inferior nitrate of silver—too much acid, especially nitric, in your nitrate bath—the exposure, too long or too short, in the camera—the absence of sufficient nitrate-of-silver solution on the film or in the developing solution—cold and dark weather—deficiency of light—too small a stop used with long focus lens.

*The film floats off, or breaks away from the glass, during development or subsequent washing.*—Defect in the collodion, or carelessness in manipulation; too much acid in the nitrate bath; plate immersed in bath too soon, or kept out too long; the edges of glass not sufficiently roughened.

*The formation of crystals under the film when dry.*—The hyposulphite solution not washed away enough. Sometimes this will show immediately; at other times it may be days or weeks before being seen.

*Irregular smears and stains.*—Dirty glasses are the most usual cause; also lifting the plate out of the nitrate bath too soon; placing it in the dark slide before the greasy lines have disappeared; not draining sufficiently, and the solution accumulating at the bottom; from dirty and wet plate-holders in the dark slide; handling the plate with dirty hands; the developing solution not flowing uniformly; pouring the developer principally on one spot; plate immersed in bath too soon, or not soon enough; developing glass not clean.

## DEFECTS IN PAPER PRINTS.

*The paper does not print equally all over; has marbled or mottled spots.*—The silver solution is too weak, or the paper has not been floated a sufficient time.

*The print when finished has a disagreeable yellow tint, and on looking through, yellowish-brown opaque patches are seen.*—The print is not fixed; the hyposulphite is too weak, or has been in use too long, or the print has not been immersed long enough to dissolve the chloride of silver.

*The whites and blacks are very brilliant, but a deficiency of detail in both.*—The negative is at fault, under-exposed.

*The prints are weak, cold, and slaty.*—Under-printing and over-toning are the general causes. The hyposulphite solution may be too strong. Over-exposed negatives produce weak prints, deficient in proper contrast.

*The prints are grey and mealy.*—Over-toning and defective paper, or general faulty manipulation.

*Red spots, streaks, and markings.*—Defects in the paper, or the albuminizing, or both.

*Prints will not readily tone, but remain of a brown, leathery hue.*—Toning bath too alkaline; chloride of gold deficient in strength; the toning-bath exhausted; the paper kept too long before being printed on, or, after being printed, kept too long before toning.

*Metallic smears, spots, stains, finger-marks, &c.*—These defects nearly always arise from bad manipulation; handling the paper with dirty fingers; allowing solutions to splash; putting the paper on a dirty table; dust and dirt in the printing-frame, or on the pads used in the latter or similar, causes; or they may occur from bad paper.

## HINTS AND GENERAL ADVICE.

THE proposed course of instruction in the usual collodion process is now completed, and practice is only required to make you entirely perfect.

Part II., you will find, is devoted particularly to the preparation of sensitive dry plates. These, however, you should not attempt until quite competent in the use of wet ones.

Part III. contains much that will be useful to you as you acquire experience, and is more addressed to the expert photographer than to the mere learner.

From the progress you may be presumed to have made, the homely and familiar style in which the instruction has been hitherto conveyed will now cease, and the remainder of the information will be given in a more condensed form.

Your attention is invited, however, to the following hints and general advice, by attention to which you will save much valuable time and materials, and render the practice of the Art more interesting and profitable :—

Concentrate your attention on the production of a good clean negative ; a professional printer may be employed to produce your prints.

Never expect the faults of your negative to be corrected in the printing ; a good print can never be produced from a bad negative.

Take pride in cleaning the glasses well ; stains and smears always indicate slovenliness and inattention.

Whenever you take a negative, take as good a one as you possibly can, even though it be a bad subject ; almost any-

thing looks well in a first-rate photograph; moreover it is excellent practice.

Never be contented with a medium picture if you can obtain a better one; "I dare say it will do!" will not do at all in good photography.

Obtain the most perfect apparatus that your means afford, and take pride in keeping them clean and in good order.

Before using your lenses wipe them with a soft chamois leather, and dust out the interior of your camera with a damp cloth.

Wipe your dark slide dry after each plate; the accumulation of nitrate of silver at the bottom corners of the dark slide stains the plate, rots the wood, and denotes the careless operator.

Carry your dark slide in a cloth when taking it from place to place (especially out of doors), and cover the top of the slide with it while the plate is being exposed.

Keep your camera exactly level when perpendicular objects are to be represented.

Get all parts of the picture into focus if you can; if you cannot, then make the principal objects the sharpest—in a portrait, the eye; in a group, the central figures; in a landscape, the foreground, in preference to distant objects.

Keep your nitrate bath always covered, and your bottles well corked and stoppered, as well as distinctly labelled.

Wash your hands after taking one picture, before commencing another.

Wash your developing-glass after each time of using.

Keep a separate vessel for every solution, and a separate bottle and funnel for each distinct purpose. Much time and

trouble in cleaning dishes and bottles will be saved, and no end of uncertainty removed.

Never open a bottle of collodion, ether, alcohol, or varnish near a flame, or an explosion may take place.

Never allow the sun to shine on the lens when taking a picture.

Never attempt landscapes on windy or misty days.

Of the two errors, under-exposure is worse than over-exposure.

Aim at good pictures rather than quick ones.

There is more certainty in working a slow than a quick process.

Learn one process thoroughly, so as to be able to depend on it; then, and not till then, amuse and instruct yourself by practising others.

Don't be led away by every fresh idea you hear; don't expect to succeed with every new process you read of, but don't condemn it because it fails in your hands.

Don't believe every novelty to be an improvement; don't hastily credit every new discovery; make great allowance for the exaggeration and enthusiasm of inventors, but keep your mind open and unprejudiced to receive every new truth, from whatever quarter it may proceed, or in whatever guise it may appear.

# PART II.

## GENERAL REMARKS ON THE VARIOUS DRY PROCESSES.

THE instruction previously given refers to the use of the collodion plate in its wet state. Experience has suggested many circumstances where it is inconvenient, or even impossible, to work the process, in consequence of the necessary attendant apparatus. Yet the desirability of obtaining photographs remains the same. Various means have been devised to use the plates *dry*, so that, being prepared before starting, they may be exposed during a journey away from home, and developed and finished on the return. This method of using sensitive plates naturally increases the usefulness of photography, but the knowledge how to prepare a wet plate is not alone sufficient to prepare a dry one. If the usual wet sensitive plate be allowed to dry, without taking any precautions, it will be found to be quite incapable of taking a photographic picture. It has to pass through another process, more or less complex, to enable it to be so used. It will be unnecessary here to detail all the methods that have been devised to so prepare the plate. It will be sufficient to describe a few of the most perfect plans.

Essentially, all the processes are the same: they nearly all start by coating a plate with collodion, and sensitizing it in a nitrate of silver bath; their differences consist in the various methods employed to preserve the sensitiveness that

the plate has attained. In most, if not in all, this sensitiveness is materially impaired; but, as the subject becomes better understood, it will probably be found that the plate in its dried state is as susceptible to the influence of light as when wet.

A sensitive dry plate is often treated as a wet plate *minus the water*, and by restoring the water the plate has been expected to return to the condition of an ordinary wet plate. Experience, however, has not quite confirmed this reasonable supposition. A re-wetted sensitive plate, even when re-immersed in the nitrate bath, does not return to the condition of an undried plate, and the mode of development so exactly adapted to the wet plate is not so well suited to the dry one when re-wetted. The conditions have changed, and the mode of development may alter too. Let the idea be once recognised that the dry plate is not bound necessarily by the conditions of the wet, and the path of discovery is opened. Great success has already been obtained by working in this direction, and that future advances will be made is extremely probable.

## ON PREPARING DRY COLLODION PLATES.

THE preparation of the wet plate being already so fully described, it will only be necessary briefly to say that all the preliminary manipulations, unless where described otherwise, are exactly the same. The point of divergence commences when the plate has been fully sensitized in the nitrate bath. Instead of putting it in the dark slide and immediately exposing in the camera, the plate is submitted to sundry

operations, and then allowed to dry. These operations distinguish the various "dry processes."

The collodion film, as already remarked, when once dried, changes its character; and when re-wetted, never returns to the previous porous, pappy condition. It becomes skinny and horny, and does not adhere well to the glass. In some processes a thin coating of an adhesive substance—as albumen, gelatine, or india-rubber—is first put upon the plate, to prevent the film slipping off when re-wetted, and during development. If it were not for the trouble, some precaution of this kind might be adopted in every case; and the operator should remember that whatever process be practised, the perfect adhesion of the collodion to the plate can be secured by using first a coating of gelatine 3 grains to the ounce of water, or of albumen, white of one egg to 10 ounces of water, or of the thinnest film of india-rubber dissolved in chloroform, benzole, or turpentine.

Another method is to varnish the plate about a quarter of an inch all round before coating it with collodion.

Another plan is to varnish the sensitive film a quarter of an inch all round before re-wetting the plate.

An excellent suggestion by Mr. Bartholomew is, to pour dilute alcohol over the plate prior to developing; this seems to restore, to some extent, the porous condition. When the alcohol has well soaked in, the plate has to be washed, and the developer applied as usual; all the subsequent operations will be made better through this preliminary wash of alcohol, the plate behaving more like an ordinary wet one, and the film adhering better to the glass.

The collodion most suitable for all the processes is the

bromo-iodized. It should be of the powdery, or non-contractile kind, and such that attaches itself tenaciously to the glass. In all instances the glasses require more careful cleaning than in the wet process, and if they be roughened about a quarter of an inch all round, it will be better than being plain, as the collodion attaches itself more firmly to roughened surfaces, and is less subject to detach itself when re-wetted.

It will be seen, in glancing over different processes, that though the final end, a sensitive dry plate, is the thing aimed at in all, the means adopted to secure it are very varied. In nearly every case a something is incorporated with the sensitive film which is not present, or even needed, when the plate is used wet. The employment of the simply washed and then dried plate is, though the easiest, perhaps the least certain of all: yet persons do use the process with success. Nearly all experimenters find that by adding a final wash of some substance, the image develops and intensifies more like a wet plate than without this addition. The number of these preservative substances is endless, and the mode of employment constitutes the different dry processes. No end of aqueous solutions of animal and vegetable substances have been used, with different degrees of success. Albumen is deservedly a great favourite. Gelatine has been applied in more than one form, and sugar in many—to wit, honey, treacle, grape sugar, brown and white sugar, candy, and caramel; many syrups, especially raspberry; different gums; solutions of malt, beer, and ale; various wines, British and foreign; liquors and spirits; milk, tea, coffee, starch, dextrine, and kindred substances; in fact, there scarcely seems a limit to materials capable of being used for the purpose, so that the question is quickly obtruded, which is the best? To this there is no

definite answer, for good pictures have been taken by every process. For absolute certainty, the Collodio-albumen, in its primitive form, is recommended; and for simplicity, the "Washed-plate."

## HOW TO DEVELOP DRY PLATES.

THERE is usually only one way to develop a wet plate; there are several ways of developing a dry one. Instead of repeating any or all of these, in detailing the dry processes, it will be better to give them fully in detail once, and refer to them afterwards.

Iron is not often used as a developer with dry plates; pyrogallic acid seems much superior. It may be used plain, or with an acid added to it, or with the addition of an alkali.

*Plain Pyro Developer.*—When pyro is used, without any addition, its strength may vary from one to five grains to the ounce of water; two grains may be taken as a medium. The dry plate being flooded with water so as to well wet the film, the pyro solution is floated over, and in a few minutes—rarely so quickly as a wet plate—the image appears. The image produced is a very weak and thin one. When all the details are fully out, then a few drops of an acid silver solution may be added to it.

ACID SILVER SOLUTION.

| | |
|---|---|
| Nitrate of silver ... ... ... | 15 grains |
| Citric acid ... ... ... | 10 grains |
| Water ... ... ... ... | 1 ounce. |

The addition of the acid silver communicates intensifying power, and the image quickly acquires density according to the quantity of silver added. When the exposure is insuffi-

cient, and the details of the image come out very reluctantly, it is advisable to use a hot solution of the plain pyro.

*Alkaline Pyro Developer.*—It is advisable to make up three stock solutions—

| | | |
|---|---|---|
| No. 1. | Pyrogallic acid ... ... | 96 grains |
| | Absolute alcohol ... ... | 1 ounce |
| No. 2. | Carbonate of ammonia ... | 96 grains |
| | Water ... ... ... | 1 ounce |
| No. 3. | Bromide of potassium ... | 10 grains |
| | Water ... ... ... | 1 ounce |

At the time of using make up the following solution—

| | |
|---|---|
| Water ... ... ... ... | 1 ounce |
| Solution No. 1 ... ... ... | 10 minims |
| Solution No. 3 ... ... ... | 5 „ |

Pour this over the wetted plate ; allow it to remain on a few seconds only, and then pour back into the developing cup and add to it 5 minims of solution No. 2, and apply again. The development will now commence, and if it be necessary, 5 minims more of No. 2 may be added, if the details indicate under-exposure. In this developing process the chief agent of course is the pyrogallic, and its power is materially stimulated by the alkaline carbonate. When these two are used alone there is a tendency very frequently to produce fog before the development is complete. The addition of the bromide corrects this. The bromide requires caution in its use, as its effect is not only to check reduction and retard development, but, if used too freely, to prevent development altogether. Therefore as little of it should be used as possible. The exact quantity may be determined by the judgment of the worker. So that there be enough present

to prevent fog that is sufficient, no matter how little that may be. If the quantity named be not sufficient to arrest fog, more must be added, the behaviour of the plate during development being, after all, the best test. The details being well out, pour off the developer, wash the plate a little, and pour back a similar quantity of No. 1, and *three times as much of No.* 2. This will usually produce sufficient intensity. If not, another application of a similar solution, or even a third one, may be used. It will be noted that the intensity is here produced without any nitrate of silver. Should there be a difficulty in obtaining intensity, the acid silver solution can be employed instead, as recommended for the plain pyro developer.

*Acid Pyro Developer.*—This developer may now be considered as an old-fashioned one, as it is being supplanted by those already given. When it is employed the exposure must be considerably prolonged. It is formed as follows—

| | |
|---|---|
| Pyrogallic acid ... | ... 1 grain |
| Glacial acetic acid | ... 30 minims |
| Water ... ... | ... 1 ounce |

The plate after being wetted has this solutionflowed over it, to which has been added two or three drops of a 10-grain nitrate-of-silver solution. Care should be taken not to add too much silver until all the details are out ; more may then be added to produce sufficient intensity.

In all instances, whatever developer be used, the plates must be fixed as usual. Hyposulphite of soda is better than cyanide to use for all dry plates. It will frequently be found advisable to postpone a little of the intensifying until after the plate is fixed, as the colour is more non-actinic than the usual wet plates, and this peculiarity of colour cannot be so well discerned prior to fixing.

## THE SIMPLY "WASHED-PLATE" PROCESS.

This is the simplest process of all, and consists in preparing and sensitizing the plate as for the wet method, then washing it well in distilled water, to get rid of all the superficial nitrate of silver solution. The plate is then to be carefully dried in the dark. The exposure should not be much more than for a wet plate. Prior to development the plate must be re-immersed in the nitrate bath, and the development conducted just the same as for a wet plate, the ordinary developing solution being used. These plates will not keep. They should be prepared over-night, and used the next day, and developed in as few hours as possible after exposure.

With favourable samples of collodion this process yields good pictures.

## THE MORPHINE PROCESS.

This process was introduced by Mr. Bartholomew, and has for its merits considerable sensitiveness united with ease of preparation. The plate is prepared with the usual bromo-iodized collodion, in all respects the same as for the wet process. After the plate is sensitized it is washed well with distilled water, and solution of acetate of morphine, one grain per ounce, is flowed over and the plate allowed to dry. The washing and flowing over of the morphine may be conveniently done by the use of dipping baths. The plates are nearly as sensitive as ordinary wet plates. The development may be either with iron, neutral pyro, or alkaline pyro. If iron be used, the following developer, as recommended by Mr. Wharton Simpson, may be employed :—

| | |
|---|---|
| Double sulphate of iron and ammonia ... | 20 grains |
| Sugar candy ... ... ... ... | 20 grains |
| Water ... ... ... ... ... | 1 ounce |

The film after exposure must be moistened with water, and the above developer flowed over. In a few minutes a well-defined phantom image will appear. A little acetic acid and a drop of a 10-grain solution of nitrate of silver are then to be added to the developer, and the image begins to gather strength.

Additional acid and silver may be added to a fresh portion of the developing solution in such proportion as the appearance of the image suggests; the acid and silver added cautiously in case of under exposure, and freely if the detail is very fully out.

In some persons' hands iron has not been so successful as a developer as pyrogallic acid. In case therefore of failure recourse may be had to that agent, full directions how to use it being given in the article, "How to Develop Dry Plates."

It should be mentioned that as these plates are not to be depended for keeping, they should be used within a few days of their preparation.

## COFFEE PROCESS.

This is a simple but excellent dry process; its peculiarity consisting only in the preservative solution being a sweetened extract of coffee. The plate is prepared exactly as for the wet process, and after sensitizing has to be well washed; it is then ready to be flowed over with the following solution, and allowed to dry :—

| | |
|---|---|
| Ordinary ground coffee ... ... | ½ ounce |
| Loaf sugar ... ... ... ... | ¼ ounce |
| Water ... ... ... ... ... | 16 ounces |

Let the water be boiling when the coffee and sugar are added. Cool and shake the vessel. The solution will keep good for a week, but must be filtered for use.

The exposure is three times that of wet plates. The development may be by either neutral or alkaline pyro.

## MR. RUSSELL MANNERS GORDON'S GUM PROCESS.

ANY good collodion may be used, but the chief commercial ones may be improved by the addition of two grains per ounce of bromide of cadmium. The nitrate bath should be acid with nitric acid, say one drop to a pint of bath. It should not be of less strength than 40 grains per ounce. Allow the plate coated with collodion to remain from ten minutes to a quarter of an hour in the bath, so as to sensitize thoroughly; wash with distilled water first, then under the tap, and finish with distilled water; next flood the plate, still wet, with a solution of three grains of gallic acid to one of water, and after draining apply the following preservative solution.

| | |
|---|---|
| Picked gum arabic ... ... ... | 20 grains |
| Sugar candy ... ... ... ... | 5 grains |
| Distilled water ... ... ... | 1 ounce |

This will require careful filtering through a fine clean sponge, or cotton wool. The plates will require to be edged with india-rubber solution before development. The exposure in summer time with good light will be about twice that of wet plates, but in winter, or a dull light, the exposure will

be proportionally longer. The *back* of the plates should be painted with some yellow, green, or red colour to prevent the light passing through and causing "blurring." This paint must be carefully removed after exposure and before developing. These plates will keep for months before exposure, and for ten days or longer prior to development, but Mr. Gordon considers it a golden rule in this, as in all dry processes, to develop as soon after exposure as it is convenient.

For development the alkaline pyro is recommended, which see; or even better, the gelatino-iron developer (see page 110), to which a few drops of nitrate of silver solution are added at the time of using.

## MR. ENGLAND'S MODIFIED COLLODIO-ALBUMEN PROCESS.

THE plate having been coated with bromo-iodized collodion and sensitized as usual in a forty-grain bath, should be washed till all greasy lines are removed; next float over the film an albuminous solution formed of one white of egg to three ounces of water and two drops of ammonia. These require to be well beaten together and filtered. When this solution has been poured over the film backwards and forwards to well permeate it, the plate has to be washed again under a gentle stream, ending with a little distilled water. The plate has now to be re-sensitized by flowing off and on a thirty grain solution of nitrate of silver, slightly acidulated with acetic acid. Again wash well and dry. This latter sensitizing gives increased vigour and sensitiveness to the plate. The exposure should be about two or three times longer than for a wet plate. Either "plain pyro" or "alkaline pyro" may be used to develop, and intensify with acid silver and pyro.

## DR. RYLEY'S FOTHERGILL PROCESS.

THE plate has to be sensitized as usual, and thoroughly well washed. Coat the plate with the following solution of albumen :—

| | |
|---|---|
| Albumen ... ... ... ... | 1 ounce. |
| Water ... ... ... ... | 2 ounces. |
| Ammonia ... ... ... ... | 30 minims. |

Beat well up to a froth, allow it to settle, and filter before use. Pour sufficient of this over the plate to cover it; let it flow backwards and forwards to soak into the film. Pour the albuminous solution away, and thoroughly wash the plate, the last rinsing being with distilled water. Let the plate dry. When perfectly dry, moisten the plate with distilled water, and pour over the following solution :—

| | |
|---|---|
| Gallic acid ... ... ... ... | 2 grains. |
| Water ... ... ... ... | 1 ounce. |

Filter the solution before using. Pour it on and off the plate to well permeate the film, then set the plate up to drain, and dry, without washing off the gallic acid solution. When surface-dry, finish by the heat of a dull fire.

These plates retain their sensitiveness well. Mr. Morley of Islington once showed me a negative that had been sensitized six months before exposure, and it was as perfect as plates newly prepared. The development of the plates may be by the plain or alkaline pyro method.

The peculiarity of this process consists in the final wash of gallic acid *after the prepared plate has dried from its albuminous coating.*

An interesting experiment was tried by Mr. Morley to test

the utility of this final wash of gallic acid. On one occasion, having some plates prepared without the gallic acid, but which, on examination prior to exposure, looked very unsatisfactory, having stains and markings of an annoying character very plainly evident, he determined to test the usefulness of the gallic acid. Upon a particular plate he poured, but on one half only, a solution of gallic acid. The plate was dried, exposed, and developed as usual, and on the half without gallic acid the image was poor, weak, and dirty; while the other side was brilliant, clean, stainless, and all that was to be desired.

## THE COLLODIO-ALBUMEN PROCESS.

This process is not only one of the oldest, but also one of the safest and most reliable of the dry processes. It is sometimes called the "Taupenot" process, in compliment to the inventor. It is in reality a double process, in which sensitized collodion and albumen each play an important part in the production of the negative. Being thus duplicated, the manipulations are more numerous than in other methods. This is probably the reason the process is less popular than the simpler ones. But its peculiarity is, that the collodion and the albumen seem to unite and support each other, and, unitedly, to do something better than they often effect separately. The process is usually described as "slow, but sure;" but with the aid of heat, and the absence of acid in the developer, it is probable that by this process as rapid pictures may be taken as by any other. It is, however, certain that by its means Mr. Mudd of Manchester, and others, have produced some of the most lovely photographs that have ever been taken.

The collodion employed is the ordinary bromo-iodized; it should be of the kind that adheres tenaciously to the glass. Pour it on as usual, and let it set well before immersing in the nitrate bath. A pneumatic holder should be used, so that the plate may be covered at all the corners. Next immerse it in the following:—

NITRATE OF SILVER SOLUTION.

| | |
|---|---|
| Re-crystallized nitrate of silver ... ... | 1 ounce. |
| Distilled or boiled rain-water ... ... | 12 ounces. |
| Glacial acetic acid ... ... ... ... | ½ ounce. |
| Iodide of potassium ... ... ... ... | 2 grains. |

Dissolve, filter, and the bath is ready for use.

When the plate is sensitized, wash it well with common water, and place it in a dish half filled with solution of iodide of potassium, three grains to the ounce, and allow it to remain while the next plate is being prepared. Then remove it from this solution, and wash it well with clean water, and pour over its surface the following solution of iodized albumen:—

IODIZED ALBUMEN SOLUTION.

| | |
|---|---|
| Distilled water ... ... | 2½ ounces. |
| White of eggs ... ... ... | 10 „ |
| Iodide of potassium ... ... | 50 grains. |
| Bromide of ammonium ... | 10 „ |
| Liquor ammoniæ (fortis) ... | 120 minims. |

Place these materials, together with some pieces of broken glass, in a bottle capable of holding twice the quantity, and agitate till the whole forms a froth, and then, when settled,

it is ready. This solution will keep a considerable time, but must be filtered before using.

Allow the solution to flow backwards and forwards, to well saturate the film; repeat this operation with a second portion, and then set the plate aside to drain on blotting-paper. When the moisture is principally removed, finish the drying before a fire, or by other convenient means.

The plate, in this condition, is nearly insensitive to light, and, provided it be kept dry, will remain good for any time.

To render it sensitive, heat it as hot as the hand will bear, and, when cool, immerse it again in the aceto-nitrate of silver bath for one minute, *using only a yellow light*, then wash thoroughly in clean water, and dry in the dark.

ACETO-NITRATE BATH.

| | | |
|---|---|---|
| Nitrate of silver ... ... | 30 | grains. |
| Distilled water ... ... | 1 | ounce. |
| Glacial acetic acid ... ... | ½ | drachm. |

When this bath becomes discoloured—which it will by sensitizing the albuminized plates—it should be poured into a bottle containing a couple of ounces of kaolin, and when well shaken allowed to rest for some hours. This will remove the colour. The kaolin may be kept in the bottle for future use.

These sensitive plates will keep good for a few weeks in warm weather, or even months in cold, if the last washing has been perfect; yet it is better to use them as soon as convenient after their second sensitizing. They will require about six times as long exposure as ordinary wet collodion, but a little over or under is not very important; an error on the former side being better than the latter, the special point

being to expose sufficiently long to bring out all the detail in the deepest shadows.

The development may be by either plain or alkaline pyro; Mr. Mudd gives the preference to plain pyro and intensifying after with acid silver.

For most interesting and lucid instruction in this process the reader is referred to Mr. Mudd's valuable *brochure*, entitled "Collodio-Albumen Process, and other Papers." This book gives the fullest information on the process, and contains Mr. M.'s narration of his own *modus operandi* in the production of those charming pictures which have made his name so famous.

## BROMIDE OF SILVER DRY PROCESSES.

Bromide of silver, as the main element of a dry process, is by no means in such general use as its great value would suggest.

All the other dry processes grow out of the usual "wet process," and, up to a certain stage, the materials and the mode of employing them, are identically the same. But with the Bromide of silver process it is otherwise. The description of collodion is different to that ordinarily used, and it is not common in commerce; the nitrate bath—if the bath be employed—is of unusual strength; and, generally, experience of working the wet process is not so directly applicable as in the other dry processes. Despite these circumstances, Bromide of silver is gradually working into favour, and the processes here described it is hoped will be found sufficiently clear for intelligent workers successfully to practise them.

There are several different variations, but the three principal ones will be detailed.

*Major Russell's Bromide Collodion Process.*—The collodion requires special preparation; it may be made as follows:—

| | |
|---|---|
| Pyroxyline ... ... | 6 grains* |
| Ether ... ... ... | 4 drachms |
| Alcohol ... ... | 4 drachms |
| Bromide of cadmium ... | 8 grains |

These should be mixed some days before use. (Ordinary *plain* collodion may have the Bromide of Cadmium added to it.) The nitrate of silver bath should be made of the strength of 70 grains to the ounce, with one drop of nitric acid to every five ounces of solution. Coat the plate with the bromized collodion, and when well set immerse it in the bath. It will have to remain very much longer in the bath than the time required for the ordinary bromo-iodized plate—from a quarter of an hour to twenty minutes—until it acquires a rich creamy tint. Wash it first in distilled water, and give it a prolonged soaking in four changes of water for, say five minutes each time, to get rid of all the free nitrate of silver. Next soak the plate for five minutes in a solution of tannin, 15 grains per oz., and let it dry spontaneously. When dry, varnish the edges a quarter of an inch round with thick spirit or other varnish. It is better with these plates, as indeed with nearly all dry ones, to coat the backs with some dark yellow material, burnt sienna or chrome yellow made into a paste with gum water, before exposing in

* The exact quantity of pyroxyline necessary to form a proper collodion film, though here stated as 6 grains, can never be given with exactness, in consequence of the variable strength and solubility of the material. In the present and other formulæ, it must be understood that the quantity named is approximate, and may be increased or decreased, as the nature of the film may suggest.

the camera, so that the defect called *blurring* may not occur. This coating of yellow material must be removed carefully with a damp sponge or rag before development.

The exposure for plates prepared in this manner is little, if any, more than for a wet plate. The development and intensification is accomplished by the alkaline method alone —which see. The fixing is done by hyposulphite as usual.

*Messrs. Sayce and Bolton's Bromide of Silver Process.*— This variation of the process mainly consists in the dispensing with the nitrate bath and using a collodion which contains the sensitive salt. The greatest care is required in preparing the collodion. It is composed as follows:—

| | |
|---|---|
| Pyroxyline ... ... ... | 6 grains |
| Ether ... ... ... ... | ½ ounce |
| Alcohol ... ... ... ... | ½ „ |
| Bromide of Cadmium ... ... | 6 grains |
| Bromide of Ammonium ... ... | 2 „ |

Mix as much of this as may be required, as it will keep indefinitely. It should stand a week before being employed.

When the above is ready for use, pound nitrate of silver to the finest possible powder in a glass mortar, and add eleven grains to every ounce of the above bromized collodion. Add it gradually, and shake it so as to get it well combined. Allow this sensitized collodion to rest for three hours before use. The mixing must be made in a non-actinic light, and the collodion must be kept in the dark. In this state the collodion will not keep for many days, therefore not much more should be sensitized than will be speedily required. Varnish the edges of the glasses a quarter of an inch with india-rubber and benzole varnish, and coat the plate with the sensitive collodion. Allow it to set well, and immerse in

a dish of water till all greasiness disappears; next put the plate in a dish containing a solution of tannin, fifteen grains to the ounce of water; or better still, use the following solution :—

| | |
|---|---|
| Tannin ... ... ... ... | 10 grains |
| Gallic Acid ... ... ... | 3 „ |
| Grape Sugar ... ... ... | 5 „ |
| Alcohol ... ... ... ... | 10 minims |
| Water ... ... ... ... | 1 ounce. |

Prepare sufficient of the above—it can be used over and over again—as follows; dissolve the gallic acid first in the water, using heat; next add the tannin, then the grape sugar. Filter, and, when cold, add the alcohol.

Allow the plate to remain in this solution three minutes. Let the plate dry evenly and quickly in any convenient manner, and it is ready for use. Expose twice or three times the time required for a wet plate. Use the alkaline pyro developer (which see,) adopting all the precautions described in the use of the bromide of potassium. If there be any difficulty in obtaining the ultimate intensity, the acid pyro and silver may be used. The fixing may be done with cyanide, as that has a tendency to counteract any splitting of the film on drying.

When experience is gained in working the process, the quantity of nitrate of silver in the collodion may be increased to twelve or even thirteen grains, accompanied with increased sensitiveness in the plate.

A very simple method of using up the residues of sensitized collodion is to add an equal quantity of plain bromized collodion, reserving the necessary addition of nitrate of silver until a few hours before it is required for using the next

time. This method prevents deterioration and loss of material.

*Mr. Cary Lea's Bromide of Silver process.*—This gentleman has recently given much attention to bromide of silver, and has devised several interesting processes. The following one has the merit of unusual simplicity.

The collodion prepared for Messrs. Sayce and Bolton's process may be employed for Mr. Lea's, but as the latter gentleman has given a formula slightly different, it is appended. The trouble of preparing the collodion will usually be much less by employing the *plain* collodion of commerce. That description, that in the wet process yields a powdery, as distinguished from a horny or repellant film, will be found to be best suited for any dry process. In all cases the unsensitized bromized collodion should be prepared in advance, so as to give plenty of time to settle and ripen. In this state it will keep any time.

Mr. Lea's collodion is made according to the following formula :—

| | |
|---|---|
| Pyroxyline ... ... ... ... | 7 grains |
| Bromide of Cadmium ... ... ... | 8 grains |
| „ Ammonium ... ... | 2 grains |
| Ether ... ... ... ... ... | ½ ounce |
| Alcohol... ... ... ... ... | ½ ounce |
| Nitrate of Silver ... ... ... | 16 grains. |

The same directions and precautions in preparing the collodion and adding the nitrate of silver, apply equally to this as to Sayce and Bolton's process. The same method may also be adopted in using up sensitized residues by the addition of unsensitized collodion, the precaution being, however, observed of keeping the mixed collodion in the dark ; for although it

is considerably desensitized by the addition of the simply bromized collodion, yet it is quite sensitive enough, even in this state to be spoilt if freely exposed to white light.

The collodion being duly prepared, and, before using, filtered through cotton wool or fine sponge—or carefully decanted, is spread over the glass plate, the edges of which have been treated with india-rubber dissolved in benzole. It is then, when well set, at once plunged in the preservative solution without any washing whatever. When removed from this solution the plate is allowed to dry, and is ready for use. The manipulation of plate-preparing consists then simply in coating with collodion, immersing in preservative solution, and drying. Can anything be simpler?

The preservative solution is a peculiar one, and its preparation is thus described in Mr. Lea's words:—"In 16 ounces of ordinary acetic acid (not the glacial) dissolve 1 drachm of acetate of lead. Prepare also a 60 grain solution of gallic acid in alcohol. Both will need filtering, and will keep a long time, probably indefinitely."

To make a bath suitable for a plate $8\frac{1}{2}$ by $6\frac{1}{2}$, take an ounce of the lead solution, a quarter of an ounce of the gallic acid solution and 6 ounces of water. Add the lead first to the water; if a precipitate take place it must be filtered; if distilled water be used no trouble from this cause will arise. It is best to prepare three such baths, for the plates are got ready so rapidly that otherwise delay will occur from want of a bath to put the plates in. Either a dish or a dipping-bath may be used.

For development the alkaline pyro method must be used, which see. Hypo for fixing.

In all these bromide processes the condition of the collo-

dion, especially the sensitized collodion, is of considerable importance. Mr. Lea has made some valuable observations "on the nature of the changes which a collodion salted with bromides only undergoes after the addition of nitrate of silver. It has been observed that when the nitrate of silver in fine powder is first shaken up with the bromized collodion, the latter, if poured on glass, is bluish and transparent. After a time it is found to have changed its character, and gives on glass a creamy and much more opaque film. Nitrate of silver dissolves very slowly in collodion, and the opinion has been, if I am not mistaken, that the change from the blue to the creamy condition marks the point at which enough silver salt had dissolved to saturate the bromide, and have an excess of silver present in the collodion.

This is very far from being the true explanation. A collodion may have a large excess of silver present in solution, and yet exhibit the blue condition. Conversely, it may have actual excess of bromide, and yet be creamy. In my opinion, the creamy condition results from an action of the bromide of silver upon the collodion itself. The following are the conditions under which it takes place:—

"The creamy condition appears after an interval, which depends upon the temperature and upon the proportion of nitrate of silver in excess. The higher the temperature of the room the sooner it comes; and it comes faster in proportion to the excess of nitrate of silver up to a certain point; but if a very large excess of nitrate (relatively) is present, it comes very slowly, or not at all. Thus, when the collodion above described was sensitized with 20 grains of nitrate of silver to the ounce, representing an excess of 6½ grains, no indications of creaminess were visible after eighteen hours,

standing in a room with fire in it. One cause of this is, evidently, that where there is so much nitrate of silver present, the bromide of silver will not remain in suspension. For when the bromide of cadmium or other soluble bromide is in excess, the bromide of silver, as is well known, shows little tendency to precipitate, but remains for a very long time suspended. When the nitrate is in small excess, there is already much more tendency to precipitate; and when as much as 20 grains is added to a collodion of 8 grains bromide of cadmium and 2 grains bromide of ammonium, the bromide of silver settles, to a large proportion, within a few hours.

"A curious fact is, that when the collodion has once passed into the creamy stage it has very little tendency to return to the blue; so that, if more collodion be added in such proportion as to leave a small excess of bromide, the creamy condition still continues. I have had collodion in which there was one grain of nitrate of silver less than sufficient to saturate the bromide, and which was perfectly creamy.

"These considerations are of no small importance in making dry plates of any sort by the collodio-bromide process; for the conditions of success are, that the film shall contain from 1 to 2½ grains of excess of nitrate of silver. Some have directed to use no excess of silver-salt, but to get the mixture as nearly neutralized as possible. I am satisfied that this is a mistake, and that the cleanest and brightest picture and most sensitive films are got with 2 or 2½ grains excess of nitrate. The creamy condition is also essential. Plates tried with even 6½ excess grains of nitrate and bluish films were very insensitive, and no good results could be developed on them."

# PART III.

## ABOUT LIGHT, AND HOW TO USE IT.

THE preceding portion of this Manual has been occupied with the description of the proper methods of producing sensitive wet and dry plates. The pupil, being supposed to be proficient, will now have to apply this knowledge to a practical end; he may attempt portraiture, still-life, landscapes, copying paintings, or the thousand and one other applications of the art, but he will speedily discover that the most important thing he has to learn is the management of his light. On the proper management of it depends the chief success of the photographer. This is the most difficult part of the art to teach, because no absolute rules or exact formulæ can be laid down. He will also have to learn that on this subject, no reliance is to be placed on lens, camera, and chemicals. These, valuable enough in their places, can teach him nothing here. He must go to the fountain head—light itself. He must teach himself to observe the apparent changes that take place on objects, according as the light plays upon them. It is not sufficient to *see* objects; he must endeavour to see them with the appreciative and discriminating eye of an artist, so as to know what are fit objects for the camera, and what are not. The same object may at one time be desirable, and at another otherwise, merely according to the manner that the light falls on it.

Whatever light falls on, it enlightens, whitens. White is

the representative of light; black, that of darkness. If an object be wished to be represented white it must be placed in the light; if black, the light must be excluded from it; if partially white and partially black, the light must be allowed so to fall on it that, while the parts that are to be represented white must be illuminated, the others that are to be black must be protected from illumination.

These principles—almost too simple to be gravely stated—contain all that is meant by "management of light." They apply universally to landscape, architecture, portraiture, and everything else. Before a photographer proceeds to take a picture he should settle in his own mind what sort of picture he intends it to be, and not wait until it "comes out" to see if it will "do." It is too late then. A man should definitely start with a fixed idea in his mind, and let his work carry it out. For instance, if he admire in portraits a broad, bold style, where the lights and shades are strongly marked and the whole picture very brilliant, let him arrange his light so that the sitter has the light falling on him in that manner, and then aim, by camera and chemicals, to accurately copy his illuminated model. If a soft and delicate picture—where half-tone abounds—be preferred, let the light so fall as to show these half-tones on the face of the sitter. Then, as before, let mechanical photography do the rest. But the first and primary condition is not to expect, by any modification of mere photography, to produce the effects that are legitimately due to light. For example, if a sitter have the light and shade strongly shown on the face by the arrangement of the light, although an under-exposed or an over-intensified negative will exaggerate the same, yet an over-exposed or under-intensified one will not make a soft picture. In like manner, if a sitter

be lighted very uniformly, though an under-exposed picture will increase the contrast, yet no management of chemicals will make it a brilliant one. The point wished to be insisted on is, that the effects due to arrangement of light should be considered quite distinctly from the effects of manipulation. A photographer can do much by both the one and the other; but he should not confound the two, nor call on one to supply the shortcomings of the other.

If the idea be distinctly recognised, that as the light falls on an object so is it represented, the question of its "management" is very simple; for the lens may be regarded as an eye, and as capable of representing objects, with the lights and shadows, only as it sees them. The photographer can, therefore, by the use of his own eye judge of the effect that his lens will see, and he may take the photograph or not, according to the suitability of the light. In out-door photography this is of the greatest consequence, for some views are best illuminated early in the morning, others late in the afternoon, and some only about midday.

In in-door work the photographer may be supposed to have the light under his control; then it is a question of placing his sitter or object nearer or farther from the window, as well as the arrangement of curtains and blinds.

The primary idea however is, before taking any photograph, to observe how the object is lighted, and to take this into consideration as of equal importance to the exposure the plate will receive, or the development that will follow. If the question of "lighting" be regarded in this true yet simple manner, the photographer has the key to the whole subject, and all the rest depends on his taste in using his knowledge.

## HOW TO CONSTRUCT A GOOD GLASS ROOM.

To have a well-constructed glass room is a matter of vital importance to either an amateur or a professional photographer, but especially to the latter. Such a room ought to permit the sitter to be properly and quickly lighted, so that good portraits can be taken with expedition. It should be adapted for working in dull weather as well as bright, and the sitter should be able to have either side of the face taken without turning the eyes to the light. The room should be well ventilated, so as to be not too warm in summer, but sufficiently so in winter; and no fumes of chemicals should be present. Many of these desirable conditions will depend on the size and aspect of the room.

During the last few years glass rooms have been built in every variety of form; but after a fair trial, practical men are satisfied that an oblong room with a ridge roof is the very best. Local necessities will often dictate the size, shape, and aspect of a room; when, however, the photographer can have control, the writer believes that a room built as he is about to describe will be found to be the most perfect for a professional photographer that present knowledge can suggest. If circumstances permit, it should be built on the ground floor. It should be oblong in form, the length running from east to west, so that one of the long sides should have a clear north aspect. Its length should not be less than 25 feet, and need not be more than 40 feet. The width may be 16 feet, but must not be less than 10 feet. Although called a "glass" room, it should be all built of substantial brickwork, except the side facing the north and

half of the roof on the same side ; these should be of glass. The south side of the roof should be slated, and the whole building should, if possible, on that side be built against a wall much higher than itself, so as to screen it from the sun at midday. Buildings, trees, or other objects should protect the ends from the morning and afternoon sunshine. A room built in this manner will be lighted only from the north, and will have the most uniform and soft light that it is possible to obtain. Undisturbed by sunshine, morning, noon, and afternoon, his light will be so steady and uniform that the photographer will be able to produce his negatives with almost absolute certainty.

Suppose a medium of the sizes referred to be adopted—say 32 feet long by 12 feet wide—a handsome apartment will be formed, large enough to take a numerous group, and to contain the apparatus and furniture of a well-appointed studio. The sides, up to the eaves of the roof, should not be less than 8 feet, and need not be more than 10 feet ; the height to the ridge should be in proportion, from 13 to 16 feet high. This will give a good slope to the roof, helping to keep the glass clean, and to prevent leakage, to which fault flatter roofs are very subject. The glass should not go to the ends of the room, but about 6 feet of each side should be bricked up, and the roof should be slated at each end about 6 feet also. If the room be 32 feet long, this will yield about 20 feet length of side and top light, all of which should have opaque blinds. As it is not advisable at any time to use more light than is necessary to illuminate the sitter, not more than half the light provided should be used at one time. A background should be placed at each end of the room, and at whichever end the sitter is placed, the blinds should be opened on that

side only; the darkened portion of the room will be pleasant for the sitter to look into, and useful to place the camera in. When the sitter is taken at the other end, everything must be reversed. As the majority of portraits are best taken with three-quarter face—the light on the near side and the shadow on the retiring side of the face—and also as a more agreeable likeness and a pleasanter expression and definition of the eyes are secured when they are allowed to look away from the light, these desirable conditions are entirely secured by this arrangement of light. The side of the room should be papered or painted of a rather light colour, but not white, and the reflection from this will, in nearly all cases, be sufficient to prevent dark shadows on the least illuminated side of the face. A screen reflector may be used if thought desirable. Considerable varieties of effect may be caused by placing the sitter nearer or further from the window. By having a background at each end of the room, either side of the face may be taken equally well, and this is a point by no means to be undervalued by the portraitist.

Though by no means so necessary as the points alluded to, yet no glass room is complete without a perfect system of ventilation, so that the greatest amount of coolness in summer and warmth in winter may be obtained, and pure air always. A room built as here described will be much more healthy than the usual conservatory-like structures, which are cold in winter, hot in summer, leaky in wet weather, and dirty all the year round. Yet all rooms devoted to photography should be thoroughly ventilated, and the chief point in ventilation is to provide for the escape of the hot and vitiated air which rises to the top of the apartment. In the glass room, therefore, the very ridge is the place. Doors and side

windows are well enough for letting in cold air, for which, by-the-bye, there is no room till the hot air escapes; but the heated atmosphere crowds to the top of the room, eager to go out in that direction, but objecting to go in any other. Provide it with proper means to get out, and the colder and purer air will always find a way to take its place. A good glass room should also be provided with means to heat it in wet and cold weather. If a hot water system cannot be used, a good household grate, giving a cheerful fire, may be provided on the bricked-up side. Above all things, that deadly abomination a gas stove, should be avoided. By attending to these minor points, though they are not photographic essentials, the sitter will feel and look more pleasant during the ordeal, and the photographer himself will derive greater health and pleasure in following his business; thus these smaller matters will help to make a well-constructed glass room more useful and perfect.

## STEREOSCOPIC PICTURES.

THE principle of Stereoscopic Pictures depends on the production of two pictures taken of the same object at slightly different points of view. Two ordinary cameras may be used, each provided with its own lens and its own plate; or the same camera may be used twice, moving it slightly on one side in the second picture, to obtain the necessary difference in the point of view. If the difference between the two points of view be considerable, the effect in the stereoscope will be that of exaggerated relief and distortion. Under all ordinary circumstances the best effect is produced by the use of the binocular camera, as the two lenses are then employed in the simplest and readiest manner, and the pictures pro-

duced have the relief of nature. It is also a great convenience to have both pictures on one glass, as one preparing of the plate serves for each. As the two pictures are thus exposed simultaneously, the same objects will be in both; whereas when they are exposed at different intervals of time, only still-life objects can be produced with certainty. The binocular camera is therefore recommended. In selecting the points of view, particularly in landscapes, it is especially desirable to have some objects in the foreground, otherwise the picture, when seen in the stereoscope, will be tame and flat. Sometimes a post, an old tree, even a few twigs, will be sufficient; but it is of the highest importance that some object should be there, so as definitely to mark the foreground, and then all other objects will fall into their relative planes, and communicate the sense of relief.

When the binocular camera is used, the pictures, after being printed, must be cut and transposed, so that the right hand one shall be placed on the left, and *vice versâ*. When many copies are wanted, it is better to cut the negative itself, transposing the two halves, and then glue them by the corners to another glass, and thus the paper prints will be printed right at once.

In producing stereo-negatives, a rather different treatment is required than for other pictures. It is not so much a brilliant picture, that may look well out of the stereoscope, that is wanted, as a soft and delicate one, that looks well in the instrument. In particular, there must be no masses of hard white light, or patches of deep black shadows without detail. The negative must be exposed sufficiently long in the camera to bring out all the details in the deepest shades; and in developing, the intensifying must not be carried so far as

to fill up any of the details in the high lights. By these means a picture will be produced which, though somewhat lacking in brilliancy out of the stereoscope, will amply repay, by the beauty of its details, when seen in it.

## HOW TO CLEAN THE SHADOWS OF A FOGGY NEGATIVE.

This must be done after the negative is fixed and washed, and before it is varnished. Make a solution of iodine 5 grains, iodide of potassium 10 grains, water 5 ounces. Pour this solution over the negative while it is wet, and let it float over it for about a minute, or until it loses its yellow colour. Wash and immerse the negative again in the fixing solution, allow it to remain about the same time as for fixing; wash well, and observe if the shadows are sufficiently cleared. If they are not, repeat the process, and continue repeating it until they are cleared. The whole picture will then be reduced in intensity, and the negative must be re-intensified in the usual manner; but this second intensifying will be confined almost entirely to the high lights. The whole operation requires care and considerable patience.

## ADVICE ABOUT CAMERAS FOR COPYING AND ENLARGING.

Pictures are sometimes required to be copied of an enlarged size. Small portraits, three or four inches square, enlarged to 10 by 8, or 12 by 10 inches, are the most usual examples. For this work a *copying camera* is required, that is, one with a long, expanding body, which should be of leather, accordion fashion, so that it may be used at various distances.

The size of this camera will be determined by the dimensions of the largest plates proposed to be used, and by the focal length of the enlarging lens.

Let a case be supposed: it is required to enlarge a picture on a $2\frac{1}{2}$ by 2-inch plate to fill a 10 by 8-inch one. For this work a good quarter-plate lens, provided with Waterhouse diaphragms, will answer. The equivalent focus of these lenses is usually about six inches. The distance the ground-glass should be from the back lens must be calculated to know the length of the camera required. The rule that determines this is simple and easy to be remembered: *Multiply the focal length of the lens to be used by the number of times of enlargement, and add the focal length to the product.* Thus, the picture is to be enlarged four times, the focal length of the lens is six inches: four times six are twenty-four; now add the focal length—six inches—and thirty inches is the distance for the ground-glass to be behind the lens; therefore, a camera that will expand to three feet will be ample. The distance for the picture to be placed in front of the lens is always more than the focal length, and less than twice the focal length; in this instance it will be $7\frac{1}{2}$ inches. If a different lens were employed, say a whole-plate lens with about 12-inch equivalent focus, the camera would have to be 5 feet long. The above examples will show that the focal length of the lens, and the number of times of enlargement of the copy, determine the length of the copying camera.

For further information on this subject, see the next article, where the subject, in connexion with the table for enlargement and reduction, is still more fully stated.

# TABLE OF ENLARGEMENT AND REDUCTION;

GIVING THE DISTANCES BETWEEN THE LENS AND THE OBJECT, AND THE LENS AND THE FOCUSSING GLASS, FOR ENLARGING OR REDUCING FROM THE SAME SIZE TO TEN TIMES THE SIZE OF THE ORIGINAL.

| Focus of Lens. | Number of times of enlargement or reduction. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Same Size. | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Inches. | Inches. | Inches. | Inches. | Inches. | Inches. | Inches. | Inches. | Inches. | Inches. | Inches. |
| 4 | 8× 8 | 12 × 6 | 16× 5$\frac{1}{3}$ | 20 × 5 | 24× 4$\frac{4}{5}$ | 28 × 4$\frac{2}{3}$ | 32× 4$\frac{4}{7}$ | 36 × 4$\frac{1}{2}$ | 40 × 4$\frac{4}{9}$ | 44 × 4$\frac{2}{5}$ |
| 4$\frac{1}{2}$ | 9× 9 | 13$\frac{1}{2}$× 6$\frac{3}{4}$ | 18× 6 | 22$\frac{1}{2}$× 5$\frac{5}{8}$ | 27× 5$\frac{2}{5}$ | 31$\frac{1}{2}$× 5$\frac{1}{4}$ | 36× 5$\frac{1}{7}$ | 40$\frac{1}{2}$× 5$\frac{1}{8}$ | 45 × 5 | 49$\frac{1}{2}$× 4$\frac{95}{100}$ |
| 5 | 10×10 | 15 × 7$\frac{1}{2}$ | 20× 6$\frac{2}{3}$ | 25 × 6$\frac{1}{4}$ | 30× 6 | 35 × 5$\frac{5}{6}$ | 40× 5$\frac{5}{7}$ | 45 × 5$\frac{5}{8}$ | 50 × 5$\frac{5}{9}$ | 55 × 5$\frac{1}{2}$ |
| 6 | 12×12 | 18 × 9 | 24× 8 | 30 × 7$\frac{1}{2}$ | 36× 7$\frac{1}{5}$ | 42 × 7 | 48× 6$\frac{6}{7}$ | 54 × 6$\frac{3}{4}$ | 60 × 6$\frac{2}{3}$ | 66 × 6$\frac{3}{5}$ |
| 7 | 14×14 | 21 ×10$\frac{1}{2}$ | 28× 9$\frac{1}{3}$ | 35 × 8$\frac{3}{4}$ | 42× 8$\frac{2}{5}$ | 49 × 8$\frac{1}{6}$ | 56× 8 | 63 × 7$\frac{7}{8}$ | 70 × 7$\frac{7}{9}$ | 77 × 7$\frac{7}{10}$ |
| 8 | 16×16 | 24 ×12 | 32×10$\frac{2}{3}$ | 40 ×10 | 48× 9$\frac{3}{5}$ | 56 × 9$\frac{1}{3}$ | 64× 9$\frac{1}{7}$ | 72 × 9 | 80 × 8$\frac{8}{9}$ | 88 × 8$\frac{8}{5}$ |
| 9 | 18×18 | 27 ×13$\frac{1}{2}$ | 36×12 | 45 ×11$\frac{1}{4}$ | 54×10$\frac{4}{5}$ | 63 ×10$\frac{1}{2}$ | 72×10$\frac{2}{7}$ | 81 ×10$\frac{1}{8}$ | 90 ×10 | 99 × 9$\frac{9}{10}$ |
| 10 | 20×20 | 30 ×15 | 40×13$\frac{1}{3}$ | 50 ×12$\frac{1}{2}$ | 60×12 | 70 ×11$\frac{2}{5}$ | 80×11$\frac{3}{7}$ | 90 ×11$\frac{1}{4}$ | 100 ×11$\frac{1}{10}$ | 110 ×11 |

This Table (page 88) shows at a glance the distance the object must be in front of the lens, and the distance the ground glass must be behind, for reducing or for enlarging to ten times the original size of the object, and the calculations are for lenses from 4 to 10 inches equivalent focal length.

For enlarging, the figures on the left side of the × give the distance from the lens to the ground glass, and the figures on the right side give the distance in front of the lens : for reducing, exactly the reverse rule applies. If the × be taken to represent the lens, the figures on each side will show how far before the lens the object must be put, and how far the ground glass must be placed behind the lens, according to the focal length of the lens employed, and the degree of enlargement required.

For single lenses the distances may be measured from the lens itself, and in Dallmeyer's triplets it may be taken from the diaphragm slot. An exact rule cannot be given for double combinations where the equivalent length of focus is unknown, but for practical use the point may be measured from the Waterhouse diaphragms, or, if they are not provided, from midway between the inner surfaces of the front and back lenses.

*To use the Table :* Suppose a picture has to be copied three times larger with a lens of 5-inch equivalent focus, and it is required to know how much the camera must be drawn out. By referring to the side column, "focus of lens," select 5, and on the horizontal line 3 will be seen 20 × $6\frac{2}{3}$. The camera must be lengthened for the ground glass to be 20 inches from the lens, or the part measured from, and the object must be $6\frac{2}{3}$ in advance of the same point. If the lens were 8-inch focus, the Table shows that the picture must be $10\frac{2}{3}$ inches

in front, and the ground glass 32 inches behind the lens, and so on for various focal lengths and different degrees of enlargement.

## HOW TO USE THE SOLAR CAMERA AND PRODUCE LIFE-SIZE PICTURES.

By the method of copying already described, pictures can be obtained considerably enlarged, and with a satisfactory degree of definition; but a bound is soon reached, in consequence of the weakness of the light, when distributed over a large surface. To meet this difficulty, the Solar Camera has been invented by an American gentleman (Mr. Woodward), which supplies the means of illumination in so superior a degree, that a new impetus has been given to the production of pictures by enlargement.

The instrument is based on the principle of the solar microscope, and is intended to be used in direct sunshine. It consists of a large strong box, some 11 inches square, with sliding adjustments, like an ordinary camera. The front has adaptations for various lenses, but an ordinary half-plate portrait lens is the one usually employed. Inside of the camera, and near the back, is placed a large plano-convex condensing lens, 9 inches in diameter, 17 inches focus, with the plane side inwards. Firmly attached to the camera-back is a glass mirror, about two feet long, and nearly a foot broad. The picture to be enlarged is placed in a moveable partition between the condenser and the portrait lens.

To use this instrument, a room with a south aspect is selected. A strong table or bench is placed under the window to support the camera. The camera is placed with its back

close to the window, all the light from which should be stopped out, except two portions, each about a square foot, through one of which the mirror should pass, and the other should be made yellow, to see to work by. A few feet from the camera is placed a screen on which is received the enlarged image magic-lantern fashion. This dark chamber becomes in fact a huge camera, in which the operator conducts all his operations. The picture to be copied must be a weak glass negative, with abundance of detail in the shadows, and not too dense in the high lights. An ordinary negative will not produce good pictures, being too opaque.

The picture should be very clear, clean, and sharp; it should not be varnished. Any size under a whole-plate may be copied, but a 5 × 4 or 1/2 plate is best. A sunshiny day must be selected, and the mirror so turned that it catches the solar rays and reflects them on the condensing lens. The size of the picture to be produced is determined by the distance the receiving screen is placed from the portrait lens; the further it is removed, the greater the enlargement. The apparatus must be so adjusted that when the picture is exactly in focus, the solar spark produced by the condensing lens must be precisely in the centre of the front surface of the portrait lens. By means of rack-work attached, the mirror can be moved in any direction to follow the motion of the sun. These movements can be made *inside* the room, which is a great convenience. A picture can be directly printed on albuminized paper in from one to three hours; but the mode generally adopted is to use a "development" process, as described on a previous page. A few seconds' exposure is then sufficient. The developing is conducted as there described, and with moderately careful management, pictures can be produced

much better in brilliancy, sharpness, rapidity, and delicacy, than by any other enlarging means. So far as *size* is concerned, the operator is bounded only by the troubles of manipulation and *matériel*, otherwise there would be no difficulty in enlarging portraits to colossal proportions, and increasing half-plate pictures to ten feet dimensions. It is not to be supposed that the same degree of delicacy of definition is retained when this great enlargement is attempted, but the general truthfulness of effect and absence of distortion is really remarkable.

## HOW TO MULTIPLY NEGATIVES.

It is often desirable to multiply a valuable negative. There are several methods of doing this, depending on the question of size. To obtain a duplicate negative the same size as the original, prepare a plate by any of the dry processes already described. Place the negative and dry plate in contact in a printing-frame, as in the ordinary printing process, and expose the frame to diffused daylight for a second or two, then develop the plate and a transparent positive will be obtained. Fix and varnish this in the usual manner, and use it with another dry plate in a similar way, and thus a duplicate negative is obtained. The transparent positive can be used to obtain an indefinite number of negatives. It should be very clear and distinct, and not very intense.

When the duplicate negative is required larger or smaller than the original, the operation must be different. Secure a room that has a window looking to the north sky. Place a shutter over this window, and cut a hole just large enough to admit the negative. Place the camera in this room opposite

the negative, and adjust by moving it backwards or forwards, until the image on the ground glass is of the size you desire. No other light must be in the room but that which comes through the negative. Take a picture now by the usual wet process, and you have a transparent positive. Put this transparent positive in the same aperture in the shutter, and proceed as before, and you will obtain a negative, and thus you can produce an indefinite number. If the above operations are cleverly managed, the resulting negatives, even though considerably enlarged, will have the characteristics of being taken direct from life, and will be superior to the best that can be obtained by copying from paper prints. Thin negatives with abundance of detail are those that copy best.

If it be inconvenient to obtain a room with a north window as described, another method of operation is by the use of the "copying camera for transparencies." This instrument, and the mode of using it, is described in the article on "Transparencies for Decorating Windows," &c., to which the reader is referred.

## HOW TO INTENSIFY NEGATIVES AFTER THEY ARE VARNISHED.

When a negative has been once varnished, its character is supposed to be so settled that it is beyond the reach of alteration or improvement. It is certainly the best plan to so consider it; yet sometimes a negative becomes so weakened in the varnishing as to cause great disappointment. It is a consolation to know that a negative need not be given up as hopeless, even under these circumstances. The method of proceeding is to make a "Negative Intensifying Varnish" by

adding tincture of iodine—alcohol 1 ounce, iodine 10 grains—to any good negative spirit varnish, until of a very deep sherry colour. Label the bottle, and keep it for special use. When a negative prints weak and without sufficient contrast, re-varnish with this varnish; pour on in the usual manner, allowing a few seconds for the yellow varnish to penetrate the film, and dry by heat in the usual manner of varnishing the plate. The negative will be found to be changed to a more non-actinic colour that will take longer to print, and will produce a more brilliant impression on paper. Many weak, thin, foggy negatives may thus be made to produce passable prints. It is well to keep two varieties of this yellow varnish; one of an ordinary sherry colour, for negatives that only want a little intensifying; and another with a very deep port wine colour—by adding a greater quantity of tincture of iodine—and using this latter for negatives that are very weak and grey. Used with care and judgment, there is no question but that these varnishes will be found extremely useful in every photographic laboratory.

A varnish of this character may also be used with advantage for varnishing the plate in the first instance, if the negative is found to be not quite intense enough, as the iodine in the varnish unites with the silver deposit, and makes the deposit much more chemically opaque than the ordinary varnish, thus increasing the intensity of the negative.

It is scarcely necessary to say that judgment must be exercised in employing these expedients, and, though useful in cases of extremity, they should never be considered as the regular practice.

## CLEANING AND RESTORING DAGUERREOTYPES.

THESE pictures frequently become obscured with a bluish film, and the picture is then said to be faded or "gone." This is a mistake, for with a little pains they can be made as perfect as ever. Carefully remove the matt and glass, paying special attention not to touch the face of the plate in this or any of the after operations, for the least touch will leave a mark that can never be removed. If any gum-paper adhere at the back, moisten and remove it. Hold the plate face upwards, resting it on the tips of the fingers, and allow water from the tap to flow over it; then pour over its surface a freshly-made solution of cyanide of potassium, about five grains to the ounce. Let the cyanide flow backwards and forwards till the discoloured film is dissolved off. Sometimes an obstinate patch will remain after the rest of the plate is clean; pour the cyanide off and on at this place, as if developing, and it will disappear.

Be careful not to use the cyanide too strong, or the picture itself will be dissolved away. It is better to employ quite a weak solution and take a little more time, than run a risk of injuring the picture. Sometimes a solution of hypo—which never injures the plate—or even plain water, is sufficient to remove the obscuring film. If these means fail, cyanide will always be found successful. When the stain is all dissolved, wash the cyanide away, finishing with a swill of distilled water, and dry the plate over a spirit lamp. The plate must not be allowed to dry spontaneously, like a glass one, but must be finished off at once with direct heat. A pair of pliers

should be used to hold the plate while drying, and the water should be made to evaporate from the upper corner downwards in one steady, uniform wave, otherwise stains will occur. It will be impossible to dry the plate off clearly unless the last wash is with distilled water, as common water, on evaporation, precipitates its impurities on the plate.

If the above precautions be taken, the Daguerreotype may be restored to all its original beauty.

## ABOUT CLEANING AND USING GLASS PLATES, NEW AND OLD.

An excellent starting point of success is to obtain a nice clean plate. A good operator knows that unless his glass is clean he has no security for obtaining a perfect picture. Many different methods have been given for effecting this apparently simple object, but the plan that seems to be perfection with one person is declared to be useless by another.

New glass plates are always best; old plates, many times used, or that have laid about with their dirty surfaces, or that have been varnished, are always to be regarded with suspicion. It is very doubtful if there is any saving in using a plate that has once been varnished. A truly economical photographer will have the courage to use the hammer to lots of his old glass, rather than risk his materials, his time, and his temper on plates which may give only dirty pictures. The chemicals, especially the protosulphate of iron and cyanide of potassium, seem to act on the surface of the glass, so that, after much using, no amount of friction with acids or alkalies will prevent smears, marks, *ghosts*, comets, rockets, and other abominations. New glass works well with very

little cleaning. Patent plate is always the best; but for small sizes up to 5 by 4, "flatted crown" will do, and "polished sheet" for larger sizes. It is a good plan, if there be a doubt whether the glass plates are flat enough, to put them into the printing-frame, and apply quite as much pressure as will occur in printing, for few things are more mortifying than to break a negative through using glass not flat.

To prevent cutting the fingers and tearing the cloths, the glasses should have their sharp edges and corners taken off; and, to make the collodion adhere well at the edges, it is better if they are roughened a quarter of an inch all round. Sand-paper, emery cloth, sandstone, or a little grooved instrument made of corundum, and sold for the purpose by most photographic dealers, may be used.

New glasses may be simply washed under the tap with plenty of water, and dried on clean cloths. When quite dry, place the glass in a plate-cleaning holder, and pour on a few drops of pure alcohol; rub this well over the plate on both sides with a tuft of cotton wool; with a second tuft rub off the alcohol, and with a third one polish the plate. This will be found a safe and expeditious method of cleaning plates. The last tuft of cotton should be kept quite clean and dry, so as to leave the plate without lines or smears. If the reader has much trouble with dirty glasses, he is strongly recommended to try "Werge's Plate-Cleaning Solution." The writer has used it for years, and is never troubled with dirty plates, and he feels he is doing his readers a service in calling their attention to this very useful preparation.

Every dark room should have a large dish provided, half filled with clean water, into which all spoiled plates should be immediately immersed, so that the collodion film should not

dry on the plate. By this plan much time will be saved in cleaning the glasses, and the plates will be kept in better order. The plates should not be left to lie in this water any longer than possible, and the water should be frequently changed. The fragments of collodion film should be added to the pan in which the silver residues are kept, as they all help to swell the amount.

## ON REDUCING THE INTENSITY OF NEGATIVES.

When a negative is too dense and it is wished to reduce the intensity, the usual recommendation is to employ a strong solution of cyanide of potassium to dissolve away the excess of density. This method is effectual when there is an excess of deposit all over the plate, and where the deep shadows will bear reducing, as well as the high lights. When, however, the density is in excess only on the high lights, and the deep shades are already too bare, this method is not only not useful, but positively pernicious; for the cyanide has a tendency to attack the weaker shades even more than the dense high lights, and a negative so treated will be found to be more injured than improved by the process. When it is wished merely to reduce the foggy deposit on the shadows, as in copying engravings, no better method can be adopted than Mr. Osborn's "clearing process." This has been sufficiently detailed on page 86.

But there is a kind of negative often produced, especially during dull wintry weather, in which the deposit is too dense on the high lights and too weak on the shades. Such negatives yield hard white and black prints, sadly deficient in half-tones. Neither of the above methods will be of any

service under such circumstances. By the use of perchloride of iron, used in the manner I am about to describe, such negatives may be materially improved and rendered frequently capable of producing perfectly satisfactory prints.

Perchloride of iron is a readily obtainable salt, highly deliquescent, very cheap, and very little goes a long way. Make a stock solution of (say) 30 grains to the ounce of water. When a negative has been fixed and washed, and is found too dense in the high lights, take a few drops of the stock solution and dilute till it has only a pale golden tint. Flow over the negative, or pour on to the particular part—face, shirt, hands, dress, or wherever the intensity is wished to be reduced. The solution acts immediately, according to the strength, making the deposit rather duller in colour. Wash well; no difference will be perceived except the slight dulness. The ordinary fixing solution, hypo or cyanide, has now to be poured over the plate, and, according to the action of the perchloride, so will be the reduction of the density.

The action is very simple, and easily understood. A layer of the reduced metallic silver forming the image is converted into chloride of silver by the perchloride of iron, which layer of chloride is instantly dissolved off in the hypo or cyanide, thereby reducing the intensity. Where the silver is most abundant on the negative there the perchloride most readily acts, and this constitutes its most useful peculiarity. It requires most carefully using, or the greater part of the deposit will be changed into chloride of silver, and be soluble in the fixing bath.

It is best to experiment on a waste plate or two before trying it on a valuable negative. If the negative is not

enough reduced by the first application of the perchloride and fixing solutions, the action may be repeated again and again, until just the desired amount of deposit is left. This is, perhaps, the safest method of using the process: by alternate application of the two solutions.

The perchloride solution should be used very dilute, scarcely coloured; it has no tendency to stain, nor eat away the weakest half tones. The fixing solution acts immediately. All that it dissolves it does at once, so that but little time is lost. A good washing is required after the hypo or cyanide, but the perchloride is rapidly washed away.

Used with care and judgment, I think this process—if such it can be called—will be found a very useful addition to negative operations. Everything may be done in open daylight.

## TO CLEAN PLATES THAT HAVE BEEN VARNISHED.

Soak the plates in a saturated solution of common washing soda, and allow them to remain until the film comes off without any friction. If the solution be made hot, a few minutes will be sufficient; but cold, they usually require from twenty-four to forty-eight hours' soaking. When the film leaves the glass freely, wash it well under the tap, and immerse the plates in weak nitric acid (water 5 ounces, nitric acid 1 ounce) for a short time. Wash well again, dry, and treat it as a new glass.

As the varnished side can never be much depended on, it is a good plan to mark the *unvarnished* side with a diamond before cleaning; and to use the marked side for putting the next collodion film upon.

## TRANSPARENCIES FOR DECORATING WINDOWS, AND FOR THE MAGIC LANTERN.

A VERY interesting application of photography is the production of transparencies for window decorations and for the magic lantern. They may be produced by the dry or the wet process. The first proceeding is to obtain a suitable negative. It should be clear, clean, and very sharp. The high lights should not be too opaque, but full of half-tone, and the shadows free from fog and full of detail. There ought to be an entire freedom from all smears, markings, stains, spots, and comets. Although there is no fixed size for the magic lantern, yet $3\frac{1}{4}$ inches square is a usual size, and for which the ordinary stereoscopic negative is well adapted; but every person will, of course, make the pictures the dimensions to suit either the lantern he uses, or the window he wishes to ornament. If the negative be the same size that the transparency is wished, the proceeding is very simple, as any of the dry processes may be employed—the "bromide" by preference, in consequence of the rich tone it gives. The negative has to be placed in the printing-frame, and the dry plate put in contact, as in ordinary printing. A few seconds' exposure in diffused light, varying with the intensity of the negative, will be enough; or gaslight may be used, when a few minutes will be necessary. The plates must be developed according to the directions given for each process. If gallic acid be used, the resulting picture will be a greenish-black tone; pyrogallic and citric acid yield a bluish-black, and pyrogallic and acetic acid a brown-black tone. The morphine process gives a rich chesnut brown that is much admired. The picture, if

intended for the magic lantern, should not be varnished, unless the blacks are foggy, but mounted by putting another glass the same size to protect the collodion film, and binding the edges like a passe-partout. If intended to be suspended as a transparency, it should be varnished and the collodion side protected with a *ground* glass. The edges may be secured like a passe-partout, to keep out the dust, and may then be framed according to taste.

If, however, the negative from which the transparency is to be made is larger or smaller than the size required, the lens and camera must be employed, and the negative must be copied *by transparency*. Many methods of doing this will suggest themselves to ingenious persons; one of these is by placing the negative in a window, all the rest of which is darkened, and copying the negative by the light that thus streams through it; the rest of the room must, of course, be in complete darkness. This method is described in the article "How to multiply negatives," but the neatest plan is by the use of "a copying camera for transparencies." This instrument is a kind of double bellows-bodied camera; that is, another body is provided *before* the lens, in addition to the usual body behind it. This extra body is provided with sliding holders, to receive different sized negatives. The screen carrying the lens can be freely moved backwards or forwards, so as to approach either the negative or the ground glass, so that either a reduced or an enlarged copy may be made. To use the camera, place the negative in its holder at one end and the usual ground glass in the other, screw the lens on to the central screen, and put it in its place. If the copy is required to be exactly the size of the original, place the negative twice the focal length in advance of the lens, and

the ground glass the same distance behind. If the size is to be reduced, push the negative further from the lens, and put the ground glass nearer ; if it is to be increased, reverse the plan, putting the negative nearer and the ground glass further from the lens. How much nearer or how much further the lens must be from the ground glass, or from the negative, depends on the focal length of the lens, and on the desired degree of enlargement or reduction. This point may, however, be remembered, that neither the ground glass nor the negative must be put so near to the lens as its focal length, or no image will be formed. See Table, page 88.

The adjustment made, the camera may be inclined to the north sky ; and the light streaming through the negative will form its image on the ground glass in the usual manner. A quarter-plate double combination lens, with central diaphragms, will be found very convenient for this work. First focus with open aperture, then put in the smallest stop, and proceed as if for producing an ordinary negative ; but instead of a negative, a transparent positive will be produced. The morphine process has already been noticed as serviceable for this work, but any other may be employed. Most usually the ordinary wet method will be found the easiest and simplest. Pyrogallic acid or iron may be used as a developer, the former by preference, as yielding a better tone and denser image. If the latter be used, and the tone be not approved, intensify, after fixing, with pyro 2 grains, citric acid 1 grain, water 1 ounce ; or, to produce blacker tones, wash the plate well from the hypo or cyanide fixing solutions, and pour on a saturated aqueous solution of bichloride of mercury, until a grey appearance is seen on the plate, then wash well, and apply solution of iodide of potassium, 2 grains to one ounce of

water, which produces a greenish-grey image ; wash, and well finish with a solution of ammonia 1 drachm, water 1 ounce, which will change the image to a black colour. If the first deposit from the developer was not very dense, these operations may be repeated ; the densest blacks may be obtained by these means.

It has already been stated that the pictures for the lantern need not be varnished. If, however, varnish be used, crystal varnish, drying without heat, will be found better than a thick spirit varnish, which would probably show markings when magnified on the screen. If the picture, on drying, be found too opaque, varnish will be found to restore transparency.

## HOW TO REMOVE SILVER STAINS FROM THE HANDS.

Recent stains on the hands are more easily removed than old ones. On the same day they are made they may be easily taken away. Wash the hands well in hot soap and water, and get off the adherent metallic silver with a nail-brush, then rub the stain with a flat piece of pumice-stone ; if the skin be not too tender, the greater part of the stain may thus be removed. Finish with a piece of cyanide of potassium, and, while the hand is still wet, rub the part gently with it, and the stain will disappear.

Older stains are not so easily removed. It is a good plan to use all available mechanical means before having recourse to chemical ones to remove the stains ; hence the hands should be well washed with warm water with plenty of soap ; this softens the hard skin ; next use the pumice-stone, and

with friction remove the mark as much as possible without making the skin smart. Take a crystal of iodide of potassium, and, just dipped in water, rub it on the mark till it changes it to a yellow patch, wash, and use the cyanide till it disappears.

Another method is to keep a saturated solution of cyanide of potassium in one bottle, and a solution, ten grains to the ounce, of iodide of potassium, to which has been added as much iodine as it will dissolve. Touch the stain first with the iodide solution, wash, and then use the cyanide, rubbing it on the yellow stains. The skin on the back and sides of the hands is more delicate than on the inside, and will not bear much friction.

The stain on the hands, if left alone, generally disappears in about a week. The nails are more difficult to clean; scraping with a penknife, after the rest of the hands have been cleaned, is the best proceeding.

Cyanide must never be used to the hands when the skin is cut, scratched, or in any manner injured, as not only immediate pain, but ultimate danger, may result from the absorption of the poison.

## REMOVING SILVER STAINS FROM LINEN.

Stains should always be removed from linen before it is sent to be washed and ironed. The heat from the ironing tends to make them more indelible, and always renders the removal more difficult. Wet the part stained, and put on a few drops of a saturated solution of cyanide, or rub it with a solid lump; if the mark does not quickly disappear, wash, and put on a drop or two of the iodine solution mentioned in the

preceding paragraph; the stain will now quickly change colour, and a little cyanide will easily dissolve it. When the linen is double, and the stain goes through, the solutions must be applied to each side.

## REMOVING YELLOW IRON STAINS FROM LINEN.

Sometimes operators' wristbands are as much stained by the iron as by the silver solutions. Yellow stains, commonly called ironmould, are easily removed by hydrochloric acid, or hot solution of oxalic acid, washing well in warm water afterwards.

## HOW TO TRANSFER NEGATIVES.

Mr. Swan has been very successful in removing negatives from glass by the following method:—Make a solution of gelatine 1 ounce, glycerine ½ drachm, water 4 ounces. Heat the negative to about 100° Fah., and pour sufficient of the above on the unvarnished film, the glass being placed on a levelling stand. About 1 ounce is sufficient for an $8\frac{1}{2} \times 6\frac{1}{2}$ plate. Allow the gelatine to set and dry spontaneously. When dry, cut all round the glass and lift the film off from one corner. Collodion may be used instead of gelatine. Take a thick plain sample, and add enough castor oil to give it a leathery consistence. Coat the unvarnished negative first with an india-rubber varnish, and when dry pour on the collodion—the negative on a levelling stand—to the depth of one-sixteenth of an inch. Let it dry spontaneously, and then immerse in water till the film floats off. Varnished negatives require the varnish to be first removed.

## HOW TO TAKE TWO OR MORE PORTRAITS OF THE SAME PERSON ON A NEGATIVE.

THERE is more than one way of performing this ingenious piece of photographic magic. The best plan is as follows :— Let a frame be put inside the camera, as close as can be to where the dark slide fits in. Let this frame have two folding doors or shutters opening in the middle, and provided with handles, so that they can be opened and shut from the outside of the camera. Make a mark down the ground glass corresponding with the join in these shutters. Now close one half of the shutter, and pose your sitter so that he shall be completely seen on the open side of the ground glass. No portion of his figure must pass into the dark side. Take the focus *accurately*, and then, without moving the focus of the instrument, or without changing any of the accessories, close the side of the shutter that has been open, and open the other side. Pose the sitter again, so that all his figure shall this time be complete, and not pass into the covered half. A plate may now be put in the camera, and each half exposed in succession, the sitter passing from one side to the other for each exposure. It will be important that the exact position be taken up each time, so that each half is perfect. If there be any difficulty in arranging this, each half of the picture may be separately examined on the ground glass before taking the other ; but the precaution must be observed that a focus be taken that will suit for both halves, for when it is once taken it must not be re-adjusted for the second half. There is no necessity that the join between the shutters should be a straight line, or that it should be in the middle ;

any line of separation that suits both halves will do, if they correspond with each other. If more than two figures are required on the plate, as many additional shutters, or portions of a shutter, will be required as there are separate figures, and all the parts of the shutters must correspond. A separate exposure for each will, of course, be required. It might be supposed that there would be markings on the plate, showing the joinings; but this will not be the case, for the light glides off and on imperceptibly, from one side to the other, if the apparatus is properly made.

By this ingenious plan a number of apparently impossible pictures may be obtained. A person at the one time may show his profile and his full face, the front and the back of his head; he may be laughing and crying; in plain dress and uniform; and under numerous other incongruous conditions.

## ON THE PREPARATION OF THE IRON DEVELOPER SO AS TO PRODUCE DENSE NEGATIVES.

When nearly the right amount of intensity is supplied by the iron in the first instance, the plan of giving a little increased density to the high lights of a negative by pyrogallic and silver is a very satisfactory mode of working; but when the original deposit is thin, grey, and metallic, then is felt the shortcomings of the iron developer; for not only does the image require a great addition of strength, but it also unwillingly takes the intensity. Under these conditions the picture requires several applications of the pyro and silver; the image has to be built up; and when the required density is produced, there is usually found a considerable loss of

delicacy. The more forcing the image requires to become dense, the less satisfactory is the result. In a well-constructed portrait studio, and with skilful manipulation, this defect, the absence of primary intensity, exists in the least degree; but it is chiefly found in working in the open air, where the sky forms a large portion of the picture; or in using samples of collodion containing a large degree of bromide; in copying some kinds of pictures; in using a collodion giving only a thin and blue film; and in using weak nitrate baths.

Next to nitrate of silver, no substance has engaged so much photographic attention as gelatine. In the beginning it was pressed into the service of photography; and more or less, through thick and thin, it and photography have stuck together to the present hour.

Gelatine added to the iron developer appears to act beneficially, both mechanically and chemically. By the increased glutinous properties it gives to the solution, it seems to flow more steadily and certainly over the collodion surface, so that, not hesitating or running into irregular lines, it does not cause the stains and markings that it otherwise is prone to. By this means the developer may be poured on more deliberately, and less solution will be required for the plate; the quantity of nitrate of silver thus becomes less diluted; and from this cause it tends to produce a more dense picture. The gelatine acts chemically by restraining the iron from acting with its usual violence, so that the silver, instead of being very quickly deposited, is done so more slowly, and in the ratio of the action of light itself. It also causes the deposited silver, instead of being thin and grey and transparent, to be dense and brown and more opaque. Moreover it

has a great tendency to prevent the silver depositing where the light has not acted, thereby keeping all the deepest and faintest shadows very pure, thus relatively increasing the density of the negative.

There are several ways in which gelatine may be added to the iron developer. Mr. Cherrill's method is well adapted where considerable intensity is required, as there is no difficulty in obtaining any amount whatever. Mix 1 ounce, by measure, of ordinary sulphuric acid with 1 ounce of water; let them cool. Then add 120 grains of gelatine; when dissolved, add a few ounces of water (say 5) and neutralize with ordinary ammonia. Add an ounce of glacial acetic acid, and make up the total quantity to 20 ounces of solution. To form a developer, prepare a 20-grain solution of protosulphate of iron, and add to each ounce from 10 minims to 1 or even 2 drachms of the above sulphuro-gelatine mixture, according to the intensity desired, remembering that the intensity will be just in proportion to the quantity of the mixture added.

The next developer is the one I most recommend :—

| | |
|---|---|
| Glacial acetic acid... ... | ... 2 ounces |
| Distilled water ... ... | ... 8 „ |
| Nelson's gelatine ... ... | ...120 grains |

Mix these together, and in a short time the gelatine will dissolve. A little agitation, or the application of heat, will facilitate the dissolution. Then add to it—

| | |
|---|---|
| Distilled water ... ... | ... 70 ounces |
| Protosulphate of iron ... | ... 2 „ |

This developing solution does not keep very well, and should not be made in large quantities. In cold weather it is apt to gelatinize, but a little warmth sets it all right. This solution

flows like oil on the plate, readily mixing with the free nitrate, and has little tendency to form stains and streaks.

The image comes out slowly and steadily, and not with a flash. The high lights, if the exposure be rightly timed, will be found to have nearly or quite the right density by the time the detail is out. If not sufficiently dense when fully developed, the solution may be poured on and off, and the density will increase; or a little fresh solution may be taken, to which a few drops of silver have been added, and any amount of intensity may be obtained. The images dry intense, and are not much reduced in varnishing.

These solutions admit of great variety of preparation, but whichever be used, persons are urged to take care and not make their negatives too intense. There is such a tendency in that direction, and this form of developer gives great facility.

## CABINET PORTRAITS.

The success of the carte-de-visite has induced enterprising photographers to extend the idea; hence the "Cabinet" portraits. These may, in one sense, be considered as cartes of a large growth, but the size is improved in its proportions. The same treatment should be used in producing these pictures as in cartes—that is, as full-lengths, vignettes, &c., and with the usual accessories characteristic of indoor or outdoor scenery. A different lens will be necessary, as those used for the cartes are too short in focus. A half or whole-plate lens, or one made expressly, will answer best.

The adopted size of the cabinet portraits is as follows:—

| | | |
|---|---|---|
| Size of mounted picture | ... ... | $5\frac{1}{2}$ by 4 |
| Mounting card ... | ... ... | $6\frac{1}{2}$ „ $4\frac{1}{4}$ |
| Opening in album ... | ... ... | $5\frac{1}{4}$ „ $3\frac{7}{8}$ |

There can be but little doubt that, by united action, this size may become a standard one, especially as albums are constructed expressly for it. This new size, among its many advantages, is well suited for portrait groups, interiors, landscapes, and many other subjects for which the dimension and proportion of the carte are quite unfitted. It will also afford a worthy opportunity for skilful photographers to break away from the little and petite effects that are of necessity peculiar to the carte size, and may lead the public to appreciate and desire larger pictures and better work, thus improving the art in every way.

## HOW TO ARRANGE THE LENSES IN A PORTRAIT COMBINATION.

THE lenses in a portrait combination are occasionally removed from their cells for the purpose of cleaning. Generally speaking, it is sufficient to unscrew the mounting, and wipe with chamois leather the two surfaces exposed. They can then be easily replaced; for the brass fittings are usually so made, that if by mistake the cells are screwed into the wrong places, the hood, or projecting shade, will not go on. The mistake is, therefore, easily detected and corrected. When, however, the lenses themselves are taken out of their cells—and, except for curiosity, this is rarely required, for the inner surfaces do not become dirty like the outer ones—the case is very different, for they may be variously transposed, and thus rendered incapable of producing good pic-

tures. There is a risk also of breaking one of the glasses of the back lens in screwing it in, unless it be put together in the proper manner. Many good lenses have been condemned as hopelessly bad through being thus transposed.

In a portrait combination there are four lenses in all, the so-called *front* and *back* lenses being really each formed of a pair. The front ones are always cemented together, and may thus be easily taken for one lens; the back pair are distinct, and are usually separated from each other by a narrow ring.

To place them in their proper positions, proceed as follows:—Take the front lens—the pair cemented together—and observe that one surface is considerably curved, and the other almost flat; place the lens in its cell, so that when screwed into the tube the curved side will be to the sitter. The two glasses forming the back lens are very unlike each other; one is thick at the centre and thin at the edge, the other thick at the edge and thin at the centre; put the thin-edged one first into the cell, resting on the least curved side; next put in the ring, and then the thick-edged glass, concave side towards the other lens; fix them in their places with the part provided, and screw the cell in its place.

With many portrait lenses there is an arrangement whereby the front lens may be used as a landscape lens; to use it for this purpose proceed as follows:—Unscrew the back lens and lay it aside altogether, as it is only required in the *double* combination; then remove the brass hood before the front lens; next unscrew the front lens, and rescrew it in the place where the back lens was. In doing this the *flat* surface will be presented to the object. The lens tube may be now put on the camera, and the Waterhouse stops will be

in their proper place for use. As the focus of the front lens, when thus used singly, is much longer than when used in combination with the back lens, the picture it will yield is proportionally larger, but a much smaller stop must be employed than when the lens is used for portraiture. The exposure will be considerably greater than when the double combination lens is used.

The front lens will, of course, have to be put in its former place, and the back lens restored, to fit it for taking portraits.

## HOW TO PRODUCE OPALOTYPE PICTURES.

When pictures are printed on opal glass instead of albuminized paper, they possess a peculiar beauty, due to the nature of the glass. Any method for producing glass transparencies will also serve for these pictures, only the printing should not be carried so far. An over-printed opalotype is always a good transparency.

*Opalotypes by the Wet Process.*—It is only necessary to use opal glass instead of patent-plate, and all the directions that are given in the article "How to Produce Transparencies for Decorating Windows, &c." exactly apply. Should the colour of the picture not be agreeable, it may be toned with gold by any of the usual processes, taking care to use the solution about one quarter the ordinary strength.

*Opalotypes by the Dry Method.*—Any of the dry processes may be employed, and the plate may be used, either in the camera, or by direct contact in the printing-frame. The development may be conducted the same as for a transparency, and, after fixing, may be toned the same as by the wet process.

*Opalotypes by Chlorized Collodion.*—To 3 ounces of ordinary plain un-iodized collodion, add one ounce of alcohol, containing 40 grains of chloride of calcium. Prepare a 40-grain bath of nitrate of silver to which is added 1 grain of citric acid per ounce. Coat the plate with the *chlorized* collodion, and, when set, sensitize it in the bath. Then wash it well, and let it dry. It is then ready to be used in the pressure-frame, like albuminized paper. The printing must be carried considerably farther than on paper. All the other operations of toning and fixing are conducted the same as with paper.

When the opalotype is produced by this method and the next to be described, a printing-frame different from the usual kind, and expressly devised for these pictures, will have to be used, so that the picture may be examined during the course of printing.

*Opalotype by Collodio-Chloride.*—The ordinary method of producing opal pictures is by Mr. Wharton Simpson's elegant process, in which the sensitive chloride is held suspended in the collodion. It is scarcely necessary to describe the preparation of the collodio-chloride as it is already an article of commerce, and is sold with full instructions for use.

The plate when coated with this preparation and dried, is ready to be used in the printing-frame, and may be printed, fixed, and toned just as a paper print, except that no more washing will be required than for an ordinary negative.

The use of opal glass as a material to print upon is strongly recommended, especially with Mr. Simpson's process, as greater justice is done to negatives, and pictures of a higher order of beauty are yielded than can be produced on paper.

## ABOUT FAILURES, AND HOW TO DETECT THEM; WITH A CASE IN POINT.*

FAILURE, as a topic, is perhaps not a cheerful one, rather humiliating than otherwise; yet, as "it is not in mortals to command success," the next best thing is to know how to avoid failure. All men know the intensity of that word "failure." It is a truth, however, that no success is solid unless built on a broad substratum of failure—failure struggled with, failure battled with, failure conquered. Few men like to own their failures, though they honourably exhibit their success. But it is no use striving to conceal it: we will fail; we cannot avoid failing: to err is human; and knowing it, let us more frankly confess it, so that we may compare our experiences, and profit by the different means we adopt to extricate ourselves from our difficulties. Some men adopt very summary means of correcting their failures: if a bath does not work well, throw it down as a chloride and make a new one; if collodion is not right, try some from another maker; if the developer is not the right thing, empty it down the sink and make up a new lot. All this is very well, for commercial purposes, when it succeeds; but it does not always do so, for a trouble is seldom entirely due to one special cause. The greatest objection, however, to this mode of getting out of trouble is, that there is so little security against falling into the same trouble again. A much better course is to try to find out the cause of the failure.

* The substance of this article is condensed from a paper read by the author before the London Photographic Society, and as it contains an example of daily experience—a difficulty grappled with and ferreted out—it is embodied here as aid to practice.

This being done, there is a good reason for thinking that that cause of failure will not occur again. In this sense failures really become stepping-stones to success. As an example of the fact that I wish to impress (that from our very failures we may derive matter for instructive papers), I will detail a bit of experience that I encountered a few months since, which caused me more vexation and annoyance than I can well tell, and which trouble, when surmounted, only humiliated me by showing how ignorant one may be on a subject on which he complacently thinks he has considerable knowledge.

I had last summer to photograph the interior of a gentleman's library. The room was not very large, the camera had to be placed in the room, and the bookcases prevented the full length of the room being used for the camera to get back. As I was so near to my objects, and as I wanted to embrace a large portion of the room, I employed Dallmeyer's rectilinear lens, which subtends a very wide angle. As I wanted great sharpness I used the smallest stop, and as the room had very strong lights and shades, a very long exposure in the camera was required to yield a soft negative. I gave the longest time I considered the plate would keep (wet collodion), forty-five minutes. The negative turned out clean and in all respects good. Here is a print from it. (Print handed round.)

Another negative was taken from another part of the library, forty-five minutes exposure, which also was quite good. (Another print handed round.) A third view from a different point was required, but circumstances prevented it being taken then. I may here mention that the chemicals employed were those daily used for portraiture. The long

exposure was the only respect in which they differed from the portrait negatives in the studio taken with the same chemicals. It was November before I could take the third view in the library, and the nature of the light had materially changed since summer. If three-quarters of an hour were required in August, an hour and a half would be needed in November. As I had no faith in a wet plate keeping that time, I must use either a dry process or a moist preservative one. I selected the moist preservative process, published by Mr. Valentine Blanchard, and which has been recommended in the "British Journal" by Mr. Harrison. It is a fluid composed of a solution of nitrate of silver, glycerine, and honey. I made up the preservative fluid as described, and, using the same chemicals daily employed in the studio for portraiture, duly prepared a plate and coated it with the preservative. I then used it in the library, which is only five minutes' walk from the studio, leaving a boy to bring it carefully inclosed in a black velvet focussing cloth. The plate was exposed for an hour and a half, and when it was developed, to my utter astonishment it was a mass of uniform fog all over the plate. I was bewildered to account for this, till I remembered that the errand-boy had brought the plate through the streets, and I had little doubt that he had opened the cloth and drawn up the slide to have a look at the plate; for he was a mischievous rascal, and had been caught at similar tricks. If this were so, it would fully account for the fog; so without questioning the boy, who would be certain to deny he had opened the slide, I directed a careful assistant to prepare another plate and bring it to the library, while I, at the library, made a careful examination of the lens and camera to see that no stray light

got in. This I anxiously did, and prolonged an extra-long hood before the lens, to keep out diffused light. The second plate was exposed ninety minutes, and on development was as much fogged as the former one. This exonerated the boy, but showed that there was something more seriously the matter than his mischief. It was possible, though, that my assistant had not exactly obeyed instructions, so I would prepare a plate entirely myself, and watch it through every stage; this I did on the succeeding day, and after the same lengthy exposure the plate on developing fogged as much as the preceding ones. Settling it that neither the boy nor the assistant was the cause, I suspected the preservative mixture: perhaps there was a little nitric acid somewhere; perhaps the sample of glycerine was not good; perhaps the honey was wrong: perhaps the nitrate bath was too old. To make certain, I made up a new bath, making it faintly alkaline, and acidifying with acetic acid; I made a fresh preservative solution, using some honey known to come direct from the farmer, and some of Price's glycerine. All the instructions that have been so lucidly given were faithfully obeyed, and at the end of a week I was ready to begin again. With great hopefulness I prepared another plate, which looked as innocent of any fogging proclivities as a plate could do; it was duly exposed, but no sooner did the developer touch it than down came the foggy precipitate on the film as bad as ever. Baffled, if not beaten, with the moist preservative, I felt I must return to the practice that suited so well in August—namely, the simple wet plate; and so far as the weak light was concerned, I must do as well as I could. I therefore banished the moist preservative and prepared a simple wet plate, as I had done before; and with largest

diaphragm of the lens I gave fifty minutes' exposure. On developing, the old trouble made its appearance, universal fog. This experiment, disheartening as it was, showed that the condemned moist preservative had nothing to do with the fogging.

Plates were prepared and used in the studio, and they were all right and no fog; but when I had kept them for fifty minutes all went wrong. I next tried whether a plate taken and put in the camera for fifty minutes, but the dark slide not drawn up, would develop clean; it did not. Still fog. I then prepared two plates exactly the same, and put the dark slides on a shelf in the dark room. After keeping one five minutes I developed, and it worked clean; after fifty minutes I developed the other, and all was fog. Now I was beginning to understand my subject; it was clear that there was something in my chemicals that gave a good picture if the plate was quickly used, but which spoilt if kept a long time.

The cause of the trouble must be either in the bath, the developer, or the collodion. I determined to examine each of these in turn. The bath, I thought, was the delinquent, so I made up two new ones—one acidified with acetic acid, the other with nitric. Many plates were prepared in these, but there was no cure from fog if they were long kept. No amount of increased acid of either kind made any material difference, so I was bound to acquit the nitrate bath.

As one of the assistants always made the developing solution, I thought that there might be some error in his mixing, so I made up new solutions of different strengths, with and without alcohol, pure and methylated; but the

final result was always the same—clean images if the plates were used quickly, nothing but fog if kept for fifty minutes. The developer was then dismissed as innocent; and nothing remained but the collodion. To test whether the collodion was really the cause (and there really appeared to be nothing else left) I obtained five samples of different makers of repute, and I allowed them twenty-four hours to rest, after being iodized, before trying them. To my great surprise, they all behaved the same as my own collodion : they all gave more or less clear pictures after keeping the plates five minutes, but they were all covered with fog if kept fifty. By this time I was completely wearied out and disheartened with constant failure. I did not want to work out this series of experiments, but I was driven to it ; all I wanted was to get the third view of the library. I kept asking myself why I could not do in November what I had no trouble in doing in August. In the hot summer months the plates would keep, but in the cool winter they would not. Seeing me thus dispirited and worn out, an assistant suggested that I should try a bottle of old collodion which contained the "bottoms" and refuse of all sorts for months past—a sort of collodion scavenger. I told him he might prepare a plate and keep it for an hour ; it could but fail as all the others had. The plate was prepared and kept for sixty minutes, and to my delight developed quite clean. I soon got my camera into the library again, and, although it was three o'clock in the afternoon, at a quarter past four I had a clean and perfect negative ; and here is a print from it. [Print handed round.] The working-out of these experiments caused no small amount of mental excitement, and occupied all the leisure time of a month. I conquered at last, and the

information to me is most valuable, having been so bitterly bought. The chief thing substantiated was, that the fact of a collodion working well when the plate is kept only for a short time, is no evidence that it will do so during a long exposure; but it is possible to have a collodion that shall be workable under both conditions, and if so, it will have to acquire this condition by age, or it must have it communicated to it by artificial means. I may say, further, that I now can understand why I succeeded with ease in August and failed so signally in November. In August I was working from a large stock of collodion, the bulk of which had been iodized fully six months before, so that a good stock quantity should be ready for summer use; but in November this was all used, and the collodion was iodized only in small quantities and at short intervals just as it was needed.

Thus ended a difficulty accidentally encountered—a difficulty fairly grappled with—a difficulty conquered.

## ABOUT COLLODION AND ITS MANAGEMENT.

Collodion with a golden colour works best; when of a deeper tint it should be mixed with some that is colourless. Newly-iodized collodion is generally improved by the addition of some old. When the sensitized film is pale and thin the iodides may be added direct to the plain collodion, instead of being dissolved in alcohol; this will yield a more dense and creamy film. When collodion is too thick, dilute with ether and alcohol, or better still, add newly-iodized thin collodion. Commercial samples frequently differ considerably in character, and may often be mixed with advantage. Horny and repellant collodion is improved by the addition of a few drops

of water. Too much water in collodion causes crapiness and honeycomb-like markings, showing chiefly in the densest parts of negatives. For those who would like to make their own collodion the following formulæ will be useful :—

## TO MAKE PYROXYLINE.

It is important to obtain the acids the correct strength, and to be careful that the temperature is correct during the time the cotton is in the acids.

| | | |
|---|---|---|
| Nitric acid, sp. gr. 1450 | ... | 6 ounces. |
| Sulphuric acid, sp. gr. 1830 | ... | 9 „ |
| Water ... ... ... ... | | $2\frac{1}{2}$ „ |

Separate the cotton into tufts not larger than an egg. Mix the acids, adding the water last, in a large basin or jar. Note the temperature with a glass thermometer. Immerse the cotton, piece by piece, at the temperature of 160° Fah. Do not put in too much cotton. Cover over, and allow 10 minutes for the acids to act. Have a vessel of water ready, and lift the cotton out of the acids with stout glass rods or porcelain dippers, and separate it as quick as possible, so as to disseminate the acids. Change the water and wring the cotton several times. Soak well so as to get rid of all acid. When litmus paper squeezed in a tuft of the cotton ceases to turn red, the cotton may be laid out to dry. It should dry spontaneously. It is dangerous to dry it by heat. Perform the operations in the open air, or near a chimney where there is a powerful draught, as the fumes of the acids are very offensive.

### A SOUND USEFUL PORTRAIT COLLODION.

| | |
|---|---|
| Pyroxyline ... ... ... | 12 to 16 grains. |
| Ether, sp. gr. 730 ... ... | 1 ounce. |
| Alcohol, sp. gr. 810 ... ... | 1 „ |
| Iodide cadmium ... ... | 4 grains. |
| „ ammonium ... ... | 4 „ |
| Bromide cadmium ... ... | 2 „ |

This collodion will keep from two to six months. It will work better a month after it is iodized than when newly mixed.

### A "KEEPING" COLLODION.

| | |
|---|---|
| Pyroxyline ... ... ... | 12 to 16 grains. |
| Ether, sp. gr. 730 ... ... | $\frac{3}{4}$ ounce. |
| Alcohol, sp. gr. 810 ... ... | $1\frac{1}{4}$ „ |
| Iodide cadmium ... ... | 8 grains. |
| Bromide „ ... ... | 4 „ |

This should not be used until after it has been made three months, and will go on improving until it is two or three years old. It should be kept in the dark.

### COLLODION FOR COPYING ENGRAVINGS AND YIELDING DENSE NEGATIVES.

| | |
|---|---|
| Plain collodion ... ... ... | 3 ounces. |
| Alcohol, sp. gr. 810 ... ... | 1 „ |
| Iodide of ammonium ... ... | 16 grains. |
| Chloride of cadmium ... ... | 4 „ |

QUICK COLLODION FOR CHILDREN.

| | |
|---|---|
| Plain collodion ... ... ... | 3 ounces. |
| Alcohol, sp. gr. 810 ... ... | 1 „ |
| Iodide ammonium ... ... | 12 grains. |
| Bromide cadmium ... ... | 8 „ |

LANDSCAPE COLLODION.

| | |
|---|---|
| Plain collodion ... ... ... | 3 ounces. |
| Alcohol, sp. gr. 810 ... ... | 1 „ |
| Iodide ammonium ... ... | 12 grains. |
| „ cadmium ... ... | 4 „ |
| Bromide „ ... ... | 2 „ |

## THE NITRATE BATH AND ITS TREATMENT.

As a rule the simpler the nitrate bath the more satisfactory it works. Nothing is better than a plain solution of nitrate of silver, from 30 to 35 grains per ounce to one of water. Common water, even though it produces slight milkiness, is often better than distilled water. If the bath fog when it is faintly acid, the fault will more likely be found in the collodion, or some other cause, than the silver solution. It is not good to use only a small quantity of solution; the largest quantity that convenience permits should be in daily use; it is then less easily put out of order. A quantity equal to what has been used during the day should be added to it every night; this solution should be from 5 to 10 grains stronger than the original strength of the bath. This will recruit it and keep it up to its work. Weak and unsatisfactory negatives are often caused by baths originally good having been

overworked and reduced in strength. If this mode of proceeding be adopted, "sunning" and other doctoring will rarely be needed. A bath that needs the doctor is generally ruined in its constitution. Rest, strengthening, and—rendered alkaline by caustic potash—a few days in bright sunshine are the best remedies; but it will rarely be so good as a new one. It has, however, been found that a sick bath has been cured by a dose of cyanide that would have killed the photographer.

When a considerable amount of bromide, 1 to 2 grains per ounce, is in the collodion, a 40-grain bath will do much better than a weaker one.

## VARIETIES OF THE IRON DEVELOPER.

Any given iron developer is a good one or not, just in proportion as it harmonizes with the other chemicals in forming a good negative. Any developer that works well may be allowed to remain; but some persons who think there is room for improvement, may find among the following solutions one that may suit them better than their usual one. The amount of alcohol necessary in the developer depends on the condition of the nitrate bath; though the quantity is omitted in all the formulæ, it must be understood that it is to be added according to circumstances. The more acetic acid present, or the newer the nitrate bath, the less the need of alcohol, but for general use half a drachm per ounce of developer is a useful proportion.*

* For further remarks see article "On the Preparation of the Iron Developer so as to produce Dense Negatives," page 108.

NO. I.

| | |
|---|---|
| Iron ... ... ... ... | 20 grains. |
| Acetate of soda ... ... ... | 6 „ |
| G. acetic acid ... ... ... | 20 minims. |
| Water ... ... ... ... | 1 ounce. |

NO. II.

Recommended by Mr. Rodgers, St. Andrews.

| | |
|---|---|
| Iron ... ... ... ... | 2 ounces. |
| Formic acid ... ... ... | 1½ „ |
| Sulphuric acid ... ... ... | 5 drops. |
| Water ... ... ... ... | 16½ ounces. |

NO. III.

| | |
|---|---|
| Iron ... ... ... ... | 10 grains. |
| Sulphate of copper ... ... | 5 „ |
| Water ... ... ... ... | 1 ounce. |

NO. IV.

Recommended by Mr. Hislop.

| | |
|---|---|
| Iron ... ... ... | 15 to 20 grains. |
| Loaf sugar ... ... ... | 50 „ |
| G. acetic acid ... ... ... | 10 minims. |
| Water ... ... ... ... | 1 ounce. |

NO. V.

| | |
|---|---|
| Iron ... ... ... ... | ½ ounce. |
| Epsom salts ... ... ... | 1 „ |
| G. acetic acid ... ... ... | ½ „ |
| Water ... ... ... ... | 16 „ |

## MAXIMS AND MEMORANDA.

When working away from home, be sure to take everything with you, and never rely upon what you can get "there." Besides, you save time, and do your work so much better. It is provoking to find you have brought everything but the dipper, or the ground-glass, or the dark slide.

Double or treble the exposure in the camera is required during an easterly wind.

Examine, and if necessary re-yellow, the window of the dark-room in the spring of the year. The chemical obstruction sufficient for winter is quite inadequate for the spring and summer.

To take quick pictures, practise cleanliness. Clean lenses, clean camera, clean windows, clean glasses, clean chemicals, clear air, and a clear head, are all necessary in working quickly.

Keep your apparatus all in good order. Don't put them away with anything defective. Nothing can be depended on if there's a screw loose anywhere.

Avoid the use of wide-angle lenses when the ordinary ones will do. They are dangerous tools to use.

Extremes of heat and cold are not good for the photographer or his chemicals. In the hot weather they are difficult to control from their exuberant activity; in cold weather they are sluggish and torpid, and lose half their power. Moral: avoid extremes. Keep your camera, your chemicals, and yourself, cool in summer and warm in winter Both you and they will work all the better with an equable temper and temperature.

THE END.